# THE JOURNAL OF GAS LIGHTING
## WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVII. No. 1967.] LONDON, JANUARY 22, 1901. [53RD YEAR. PRICE 6d.



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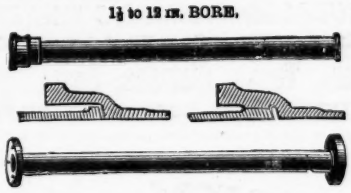

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# THE "MELDRUM" FURNACE
*At "The SHEFFIELD TELEGRAPH" Offices.*
**Reprinted from "The SHEFFIELD TELEGRAPH" June 27, 1900.**
## A SAVING IN FUEL OF £18 PER WEEK.

A couple of months ago when coal, which formerly cost us 8s. per ton rose to 12s. 6d., we read a lecture on the cost of steam production by John Holliday, in which the following paragraph appeared:—

Mr. Bryan Donkin, M.Inst.C.E., has published figures from some tests he carried out with different kinds of fuel in the same boiler, the conditions in all cases being the same; the results are comparable on the basis of the cost of fuel required to evaporate 1000 gallons.

| Kind of Fuel. | Cost of Fuel per Ton. | Water Evaporated per Pound of Fuel. | Cost of Fuel per 1000 Gallons Evaporated. |
|---|---|---|---|
| | s. d. | lbs. | s. d. |
| A. Dust Coke . . . . | 5 0 | 6 | 3 8 |
| B. ,, Welsh Coal . . . | 10 0 | 8 | 5 3 |
| C. Large ,, . . . | 22 0 | 9 | 10 11 |

Discovering that the Sheffield Gas Company made a considerable quantity of coke dust, which they gave away to builders and others, we entered into a contract for a supply for three years. Having a spare boiler, we had Meldrums' forced draught fitted, and soon discovered that coke dust made a very satisfactory fuel for steam raising. Our second boiler was then fitted, and we are now burning coke dust on the two almost exclusively. From an economical point of view, the experiment is very satisfactory, as will be seen from the following figures:—

*Average week, Coal only, on One Boiler.*

| | £ s. d. |
|---|---|
| 45 Tons at 12s. 6d. . . . . | 28 2 6 |
| Ashes at 2s., Seven Loads . . . . . | 14 0 |
| | £28 16 6 |

*Present Consumption on Two Boilers.*

| | £ s. d. |
|---|---|
| Six Tons of Coal at 9s. 3d. . . . . | 2 15 6 |
| Coke Dust . . . . . | 3 4 0 |
| Two extra Stokers . . . . . | 2 12 0 |
| Flues cleaning . . . . . | 10 0 |
| Ashes, 12 Loads at 2s. . . . . | 1 4 0 |
| | £10 5 6 |

We shall be pleased to show the arrangement to anyone interested in the subject of the economical production of steam. There is no smoke from the chimney stack of the "Telegraph" Office, which is another good point in favour of coke dust as fuel.

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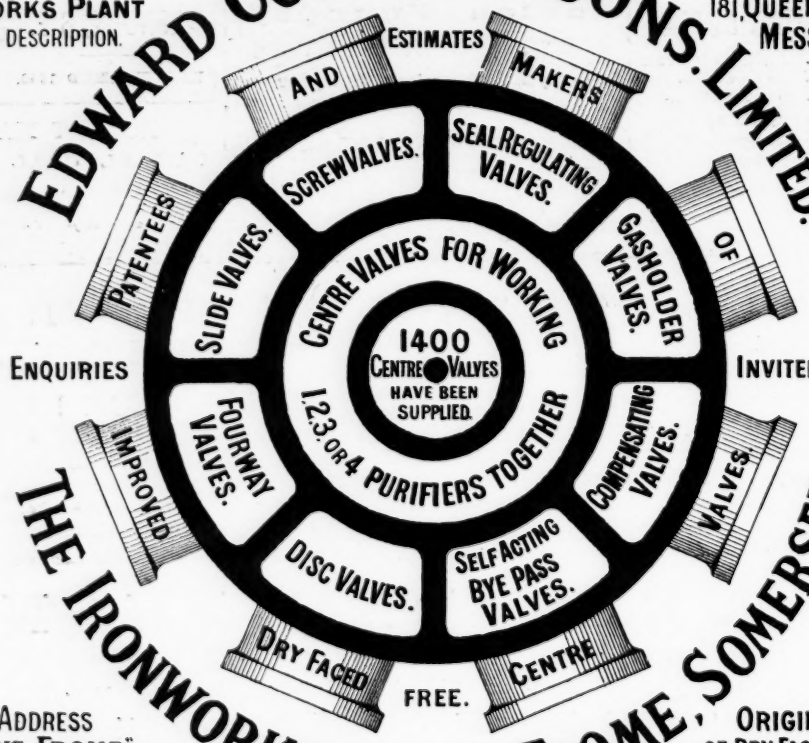


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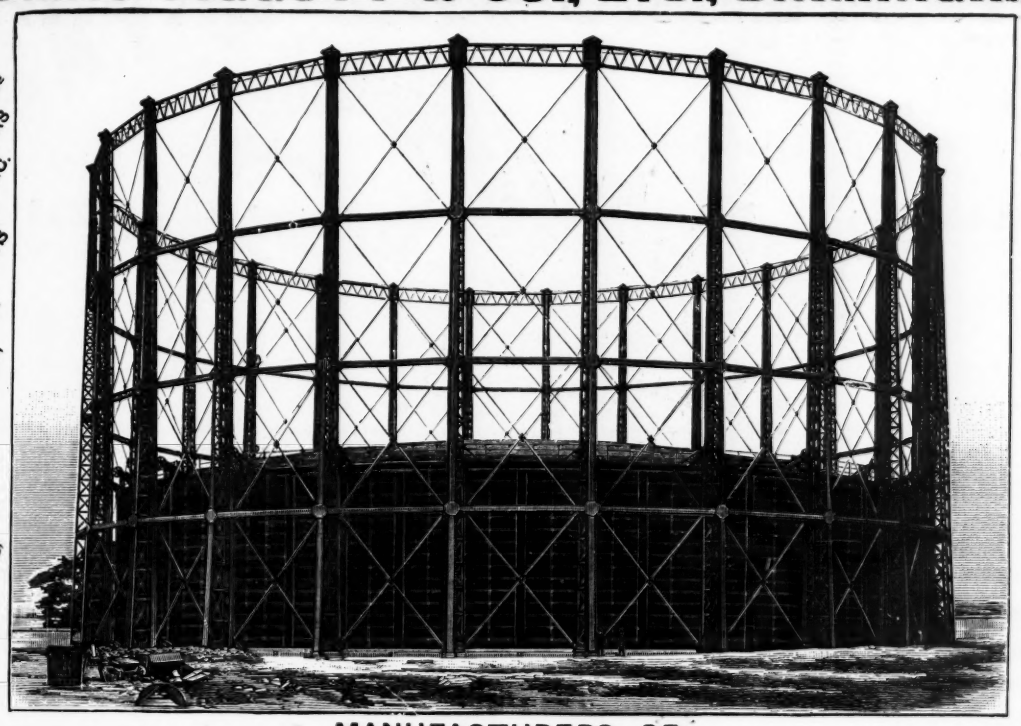

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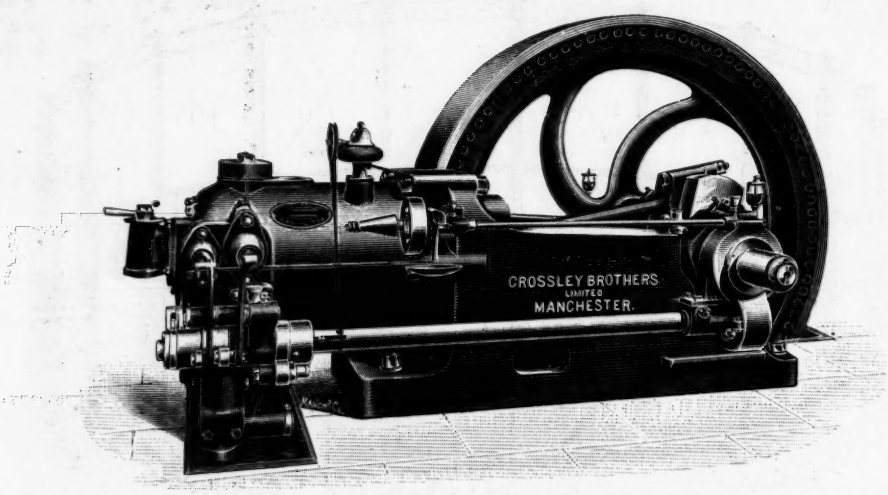


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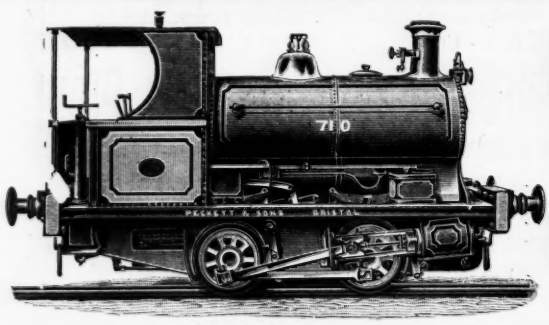


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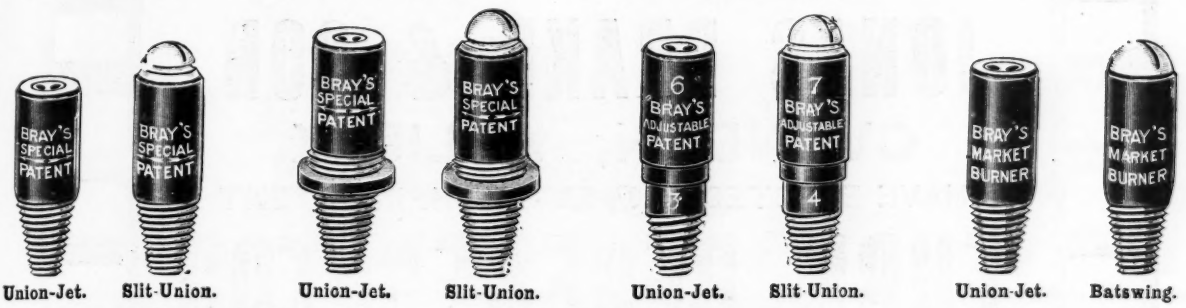


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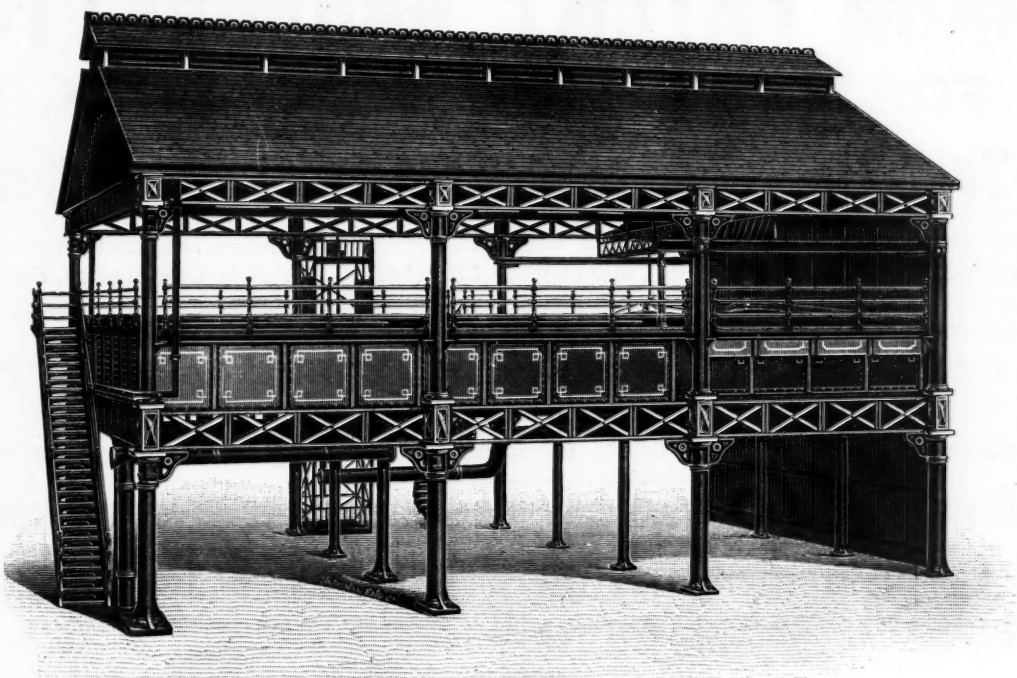

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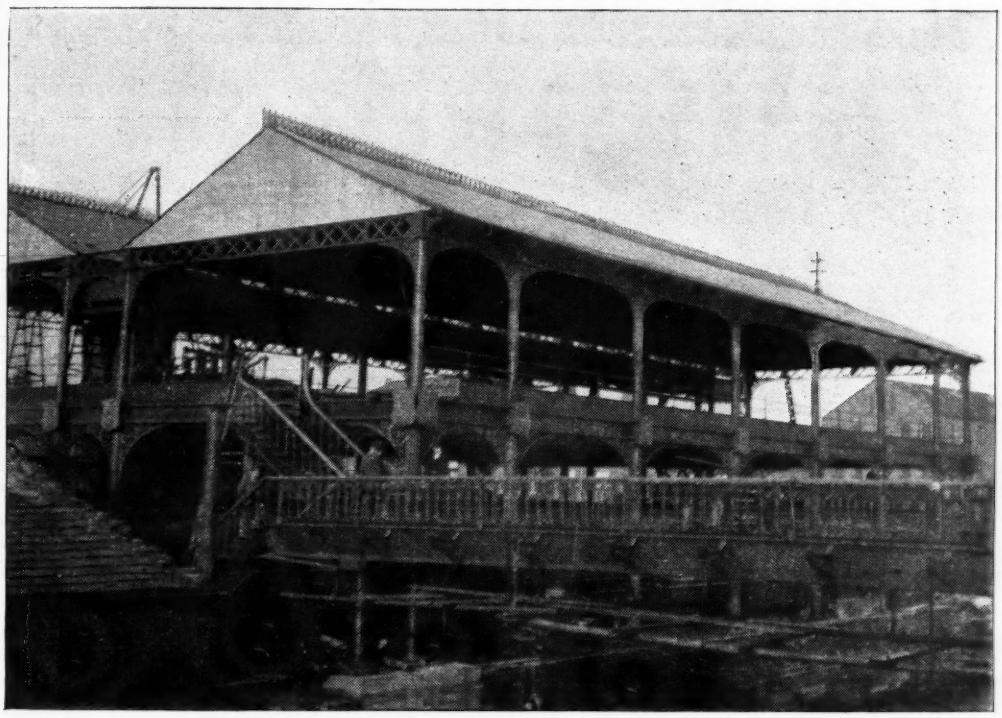

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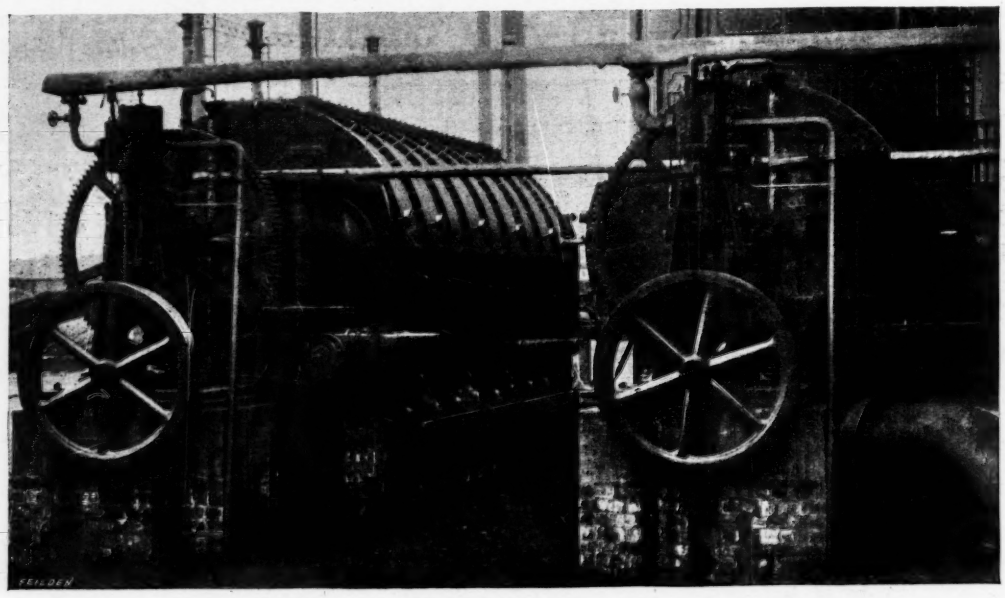

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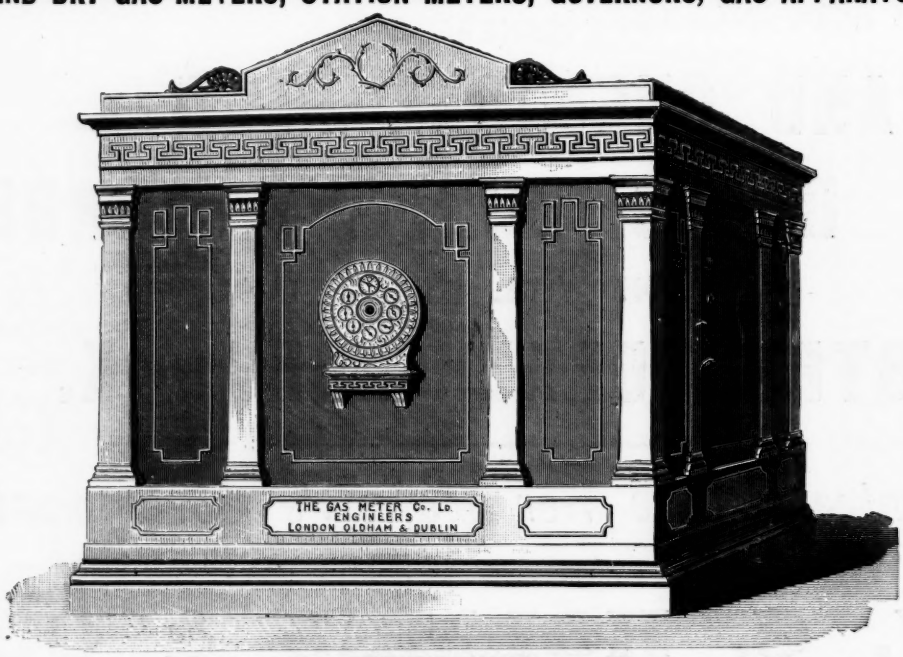


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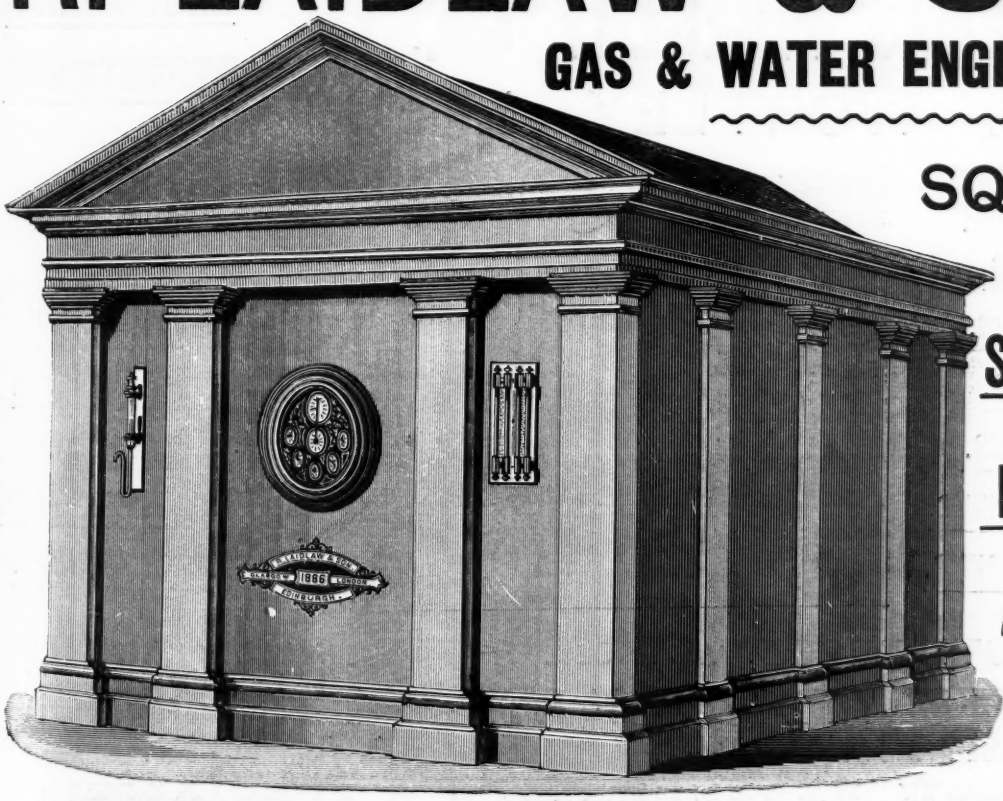


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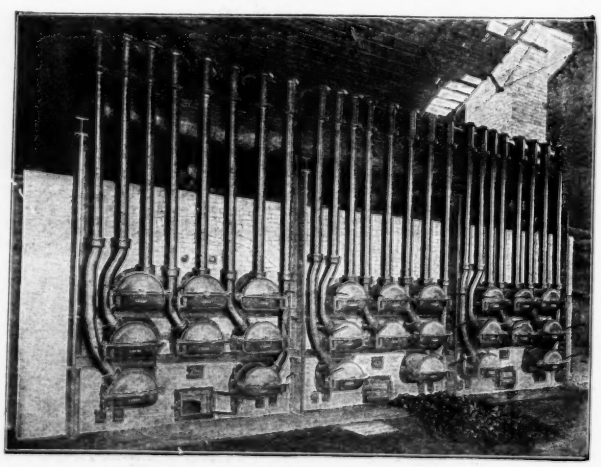

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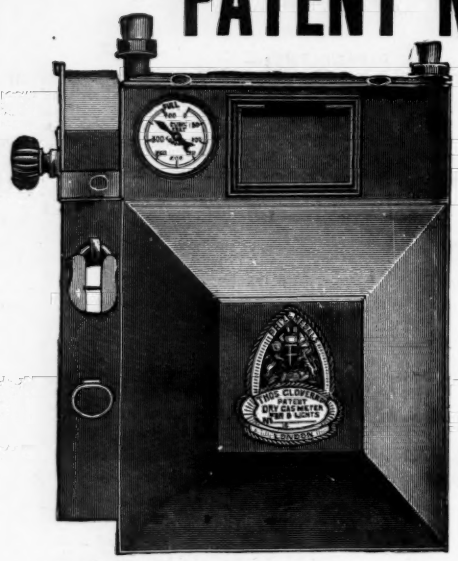

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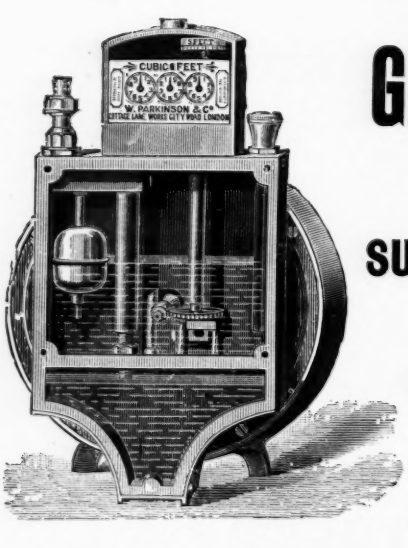


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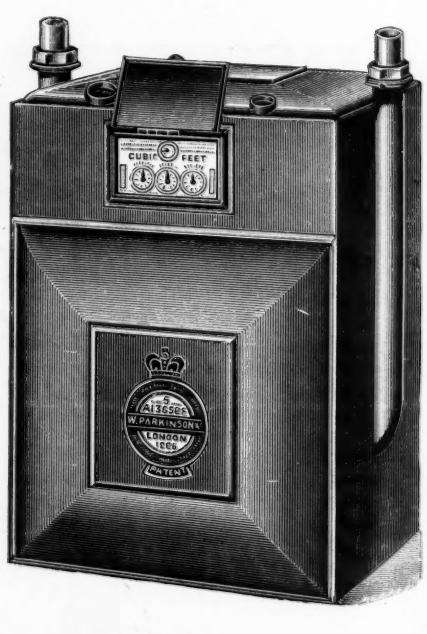


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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

VOL. LXXVII., No. 1967.——TUESDAY, JANUARY 22, 1901.

# EDITORIAL NOTES.

## The Question of Electrolysis of Gas and Water Mains.

It is greatly to be hoped that, before the vastly extended electric tramways and railway business with which this country is threatened goes much farther on the way to realization, something like an agreement may be arrived at, among the various interests concerned, with respect to the question of electrolysis of gas and water mains, and how to prevent it. We mention in another column to-day the weighty opinions on this subject of Mr. C. H. Wordingham, the Electrical Engineer to the Corporation of Manchester. Manchester is interested in the matter on all sides. If the Corporation electricity leaks out of the Corporation tramway metals, the Corporation gas and water pipes will suffer by it. Of the reality of the risk of something of the kind happening, Mr. Wordingham has no doubt whatever. Unlike most electricians, however, he is free to confess his feelings in this regard, which he has done with a candour and force that leave nothing to be desired. He foresees a development of electric tramways—to say nothing of underground or ordinary railways worked by the same means—such as imagination has scarcely yet risen to. Incidentally, he expects the elimination of omnibuses, an enormous diminution in the use of cabs, a great reduction in the number of vehicles of all kinds, and a considerable acceleration of the speed of all town transport. Heavy goods will also be carried by night; thus still further clearing the streets.

Without following Mr. Wordingham into all his somewhat rhapsodical anticipations of the immediate and consequential effects of electric tramway working, we can return to earth in his company, after these prophetic exercises, and confer with him as to the condition of affairs brought about by the general acceptance of the overhead trolley-wire system. Undoubtedly, public opinion in England has gone a long way towards being reconciled to the overhead wires; but Mr. Wordingham does not affect to like the system on any ground, and declines to esteem it a final solution of the electrical and mechanical problem. He brings up sharply, at the outset, over the question of electrolytic damage to buried pipes, which, he admits, if it occurs at all, will have "appalling" consequences. The most striking of his observations in this connection is that the arbitrary prescription of the Board of Trade, of the permissible drop of voltage in the tramway returns, is no adequate protection. Unless something very much better than this is found, he declares that the evil day which has already come for America in this regard will only be postponed for us. Note what this means. Not only is the whole soil of American towns electrolytic, so to speak, thereby reducing the lifetime of gas and water mains and pipes to a question of a few years (sometimes of months); but the best expert opinion has failed to find a remedy—only palliatives having been hit upon. A new order of specialists in diagnosing electrolysis has sprung up in the United States, who would make speedy fortunes if they could cure the mischief they can only trace out.

The prime cause of this evil is at once the most material, and the most elusive, of common electrical phenomena. It is directly and solely due to the leakage of current from the conductors duly provided for it. There is here no question of "induction"—that magneto-electric phenomenon which has so much the appearance of "action at a distance." The leakage is about as substantial a fact as anything in all electricity, and has its physical equivalent in the weight of fuel required to generate the wasted current. Its elusiveness is another and a less simple quality. It will leave a tramrail, and go into a neighbouring gas or water main by some line of least resistance picked out by itself. This does no harm to the pipe, provided the current, whatever it is, would only stay there, or only went that way occasionally. But when the action is continuous, the current has to pass along the pipe, spanning the joints, until it finds physical cause for leaving it; and wherever the point of departure, as at every spanned joint, the parting guest takes toll of the metal that has harboured it. Suppose the current to find its way back to the tramrail at another point, the net result might be (as Mr. A. C. Trotter has shown) that great mischief might be going on somewhere, although the fall of potential from end to end of the tramrail might be but small. It is the exchanges that cost iron.

Mr. Wordingham suggests that the best preventive of this give-and-take process, as between tramrail and main pipe, lies in reducing the length of travel of current in the former. If the power stations are situated at intervals of not exceeding a mile, the rails will only have to carry their slippery charge for half the distance before being relieved of it; and this he thinks might justly be expected of them. This expedient seems reasonable; but it is not the usual way in which electric tramways are worked, especially in America. The big single power station appeals to mechanical engineers and electricians as the most desirable arrangement; but, as Mr. Wordingham justly points out, the actual feeding of the power wire can still be done through substations connected by cable with the main station. There is only too much reason to fear, however, that, unless the tramway authorities are held strictly responsible for all the damage done to gas and water mains—as fully as though this property were their own, as in Manchester—they will fail to see the necessity of taking this, or any other, measure in the interest of public security.

## Labour Last Year and in the Future.

The report on the state of the labour market during the last month of 1900, the summary of the changes in wages and hours of labour during the whole of the year, and the preliminary statistics of the trade disputes reported upon in the twelve months, were published last week, and are all in various ways instructive. The condition of the labour market in December was eloquent of the reaction that has set in in the trade of the country. The percentage of unemployed members of the Trade Unions making returns to the Board of Trade was just 4 per cent. last month, as compared with $3\frac{1}{5}$ per cent. in November, and $2\frac{1}{2}$ per cent. a year ago. The only important trade in which employment can be said to be readily obtainable is that of coal mining; for although the number of days worked per week shows a tendency to decline, the number of men employed is on the increase. In the pig-iron trade, the state of employment is much worse than a year ago, and is declining steadily. At the works covered by the returns, the number of furnaces in blast at the end of the year was only 326, as against 342 and 379 a month and a year earlier respectively. A decrease of 53 furnaces in blast represents, it may be interesting to note, a reduction in the consumption of coke equivalent to 70,000 tons of coal per week, or (say) 3,500,000 tons per annum.

In the iron and steel manufacturing works, and in the engineering and metal trades, employment continues to fall off—comparing unfavourably with November, and still more so with the corresponding period of 1899. The tinplate trade—in which such large quantities of steel are used, and which is feeling acutely the effects of American competition—the decline is very marked; the number of rolling-millls at work at the end of December being 9 per cent. less than at the beginning of the month, and 21 per cent. less than at the end of 1899. Moreover, the mills that are running are not working at such pressure as a year ago. The outlook for the working classes as regards employment during this new year is not, then, by any means so good as it was in the spring of 1900. Neither, of course, can they look forward to a maintenance of the high rates of wages obtaining during that year.

As will be seen from the notes published elsewhere upon the changes in wages and hours of labour in 1900, that year was the culmination of a period of five years of rising wages, and was, moreover, that in which by far the largest increases were recorded. The net rise in weekly wages last year was, in fact, approximately equal to the total of such increases during the three preceding years. We have estimated that the rates of wages in force at the end of 1900 were higher than those ruling five years earlier, to an extent that represents an increase of £25,000,000 in the annual wages-bill of

the country, excluding any increments granted to railway servants, seamen, or agricultural labourers. Had this amount been equally distributed over all classes of workpeople other than those just mentioned, it would have meant an increase of something more than 1s. per head per week. But, as a matter of fact, the proportion of the population affected was comparatively small; the rise being very high in some trades and nothing at all in others.

It is, in fact, the coal miners who have received the major portion of these larger wage payments. In 1900, the addition to the weekly bill in all trades amounted by the end of the year to £203,240. Of this, not less than £163,870 went to the miners, whose wages stood on an average 5s. a week higher at the end of December than they did at the beginning of January, 1900. Under the agreement between the Federation owners and the men, further increases come into operation this month and next; but the prospect in the coal trade is such that decreases must form the order of the day in the not distant future. The Scottish coal owners have, indeed, already opened the question of a reduction. At a recent meeting, they passed a resolution to the effect that, "looking "to the present state of the coal market and of the iron, "steel, and other trades in the country, a very substantial "reduction of miners' wages is urgently needed;" and they instructed their representatives on the Conciliation Board to arrange for an early consideration of the matter.

The miners in Scotland are receiving wages 100 per cent. above the standard rates of 1888; they last year imposed the eight-hour day upon the masters—conceding at the time eleven working days instead of ten in the fortnight; the masters are now seeking to abolish the eight-hour day, while the men desire to retain it and at the same time to revert to a ten-day fortnight; and, finally, the miners are up in arms against the employment of the "more docile" Poles in the mines. From this bald statement of the existing elements of disagreement between owners and men, it may be gathered that the Scottish Conciliation Board will have its hands full during the coming weeks.

The brief summary of trade dispute statistics for 1900 which will also be found in another column, shows that last year there was 50 per cent. more time lost through strikes and lock-outs than in 1899 (a year remarkably free from labour troubles). The closing months of 1900, indeed, witnessed the revival of industrial discontent in some of its most unreasonable aspects; and, having in mind the growing depression in trade, the high wages, accumulated funds, and aggressive spirit of the miners, we cannot but fear that the first year of the new century will prove one of no little anxiety, trouble, and probably loss to employers—and that at a time when the nation can very ill afford to waste her resources in internecine strife. It is, we fear, vain to hope that a labour "leader" may be found to preach the truth to his fellows.

### Foreign Competition and the Coal Trade.

THE coalowners are stubbornly struggling to avoid the inevitable, and evince no desire to remedy in any way the damage they have done to the trade of the country by abating their prices to an extent sufficient to save, if it be not past salvation, the business of their best customers from a period of severe depression and difficulty, and the industrial advancement of the nation from a serious set-back. The iron and steel trades go from bad to worse, and in every direction manufacturers are seen to be closing works or curtailing output. The Cleveland iron-makers have, in fact, agreed upon a systematic reduction of manufacture, though stocks are by no means high; and no one can deny the wisdom of their so doing. The step is an unusual one for them to take, as the more general practice is to keep the works going at a fair average output, and let stocks accumulate. But this would not be a wise course to follow under existing conditions; for with coal at its present price, the cost of manufacture is so high that were makers now to pile up stocks, they would run the almost certain risk of having to sell later on at less than cost price. The consequence of this curtailed output must necessarily be an artificial maintenance of iron prices. It may not stop the fall that is going on; but it will certainly retard and lessen it.

A further consequence, however, will be a hastening of the downfall of coal; for the consumption of fuel by the iron and steel trades must, of course, diminish proportionately to the reduction in their output. Every blast-furnace consumes in coke the equivalent of about 1300 tons of coal every week; and since the beginning of September furnaces have been put out of blast in such numbers that the reduction in the consumption of coke in furnaces for the four months must have been equal to little short of 500,000 tons of coal, and at the present moment is less by the equivalent of 60,000 tons per week than it was at the end of August. But, at the same time that the consumption of coal is falling off, the output is increasing, not only in this country but elsewhere. For the eleven months to November last, the quantity of coal raised in the three principal mining districts in Germany was 4½ million tons greater than in the same period of 1899; and advices from Hamburg state that the scarcity of coal prevailing there last year has recently given way to very heavy stocks and an almost stagnant demand. In Germany, as here, dear coal has seriously damaged trade. The year's output for the United States is estimated at 241 million tons in 1900, as against 225 millions in 1899; and although this large increase has little direct effect upon our home market, the plentiful supply in the States has enabled American coal to relieve us of some of our customers abroad. The imports of coal into Genoa last year included 75,000 tons more from the States than in 1899, when the quantity so imported was but small.

The fact that coal has been plentiful and cheap in America has, however, had a very much greater effect upon the position in this country, by reason of its enabling the iron and steel manufacturers to avail themselves of the state of our markets. During the second half of 1900, steel has been pouring into our ports from abroad; the United States shipping to us last year no less than 157,000 tons—an increase of about 100,000 tons over 1899. Foreign competition has, in fact, done very much for the consumer these past few months; but it is to be hoped that coalowners will wake up to the realities of the situation. Our manufacturers will have difficulties enough wherewith to contend, without the handicap of dear coal at the commencement of their struggle with their foreign rivals.

If warning and exhortation can move our manufacturers to so set their house in order as to be able to successfully resist this onslaught of foreign competition, the thing will be done. The daily, weekly, monthly, and quarterly periodicals are full of warning and advice—much of the nature that proposes a remedy to which the disease is decidedly to be preferred; and speakers innumerable, both great and small, exhort the nation to gird up its loins for the struggle that is upon it. Lord Rosebery, speaking on Wednesday to the Wolverhampton Chamber of Commerce, returned to the subject on which he so impressively held forth at Glasgow some while ago; and his words were endorsed the following day by no less an authority on the iron industries of the country than Mr. Chamberlain, at the first annual meeting of the Governors of Birmingham University. Mr. Chamberlain spoke of the urgency and necessity of the better scientific training which it is hoped may be provided by the new University—training designed especially for practical application to the purposes of industry; and there is no question but that more rational and complete systems of education are greatly needed to render the nation more efficient as a productive community. But there is "one "thing needful," without which the most perfect systems of education in the world can be of no avail; and that is—to quote a pessimistic writer in the "Fortnightly Review"—"a renaissance of the whole spirit of the race," a realization by all classes of the need of greater earnestness in their work, and of the need for the better education it is proposed to supply. First of all, though, the coal owners and coal miners have to be brought to reason. We cannot face foreign competition at all with coal at present prices.

### The Æsthetic View of Gas-Fires.

THE interesting letter of Mr. Thomas Fletcher on "Gas-"Fires," which appears in our "Correspondence" columns to-day, affords an opportunity for extending the observations on the place filled by these appurtenances of town life and middle-class housekeeping, which originally evoked this communication. Far be it from us to depreciate the valuable work done these fifteen years past, as he truly states, by Mr. Fletcher, in the adaptation of this kind of gas appliance to the requirements of gas companies and their customers. It is rather surprising to hear that there is so large a hiring-out business in them; the more general impression having been that they are not in great favour as investments for gas companies' precious capital. The point about gas-fires being tenants' fixtures was fully admitted in our essay. This fact accounts, as Mr. Fletcher says, for the large volume of trade

done in low-priced articles of the kind—makeshifts, we called them, made to stand on the hearth-stone in front of the empty coal-grate, or else to hang upon its cold bars. These things answer the user's purpose; and they are not unsatisfactory either to the makers or to the suppliers of gas. All that is well understood. So, also, is the case for a more permanent, systematized application of gas-fires of a better class to the warming of counting-houses, shops, consultation-rooms, and interiors of this extensive order in town buildings. What with one class of trade and the other, there is no reason to fear that the manufacture of gas-fires, as we know them to-day, will fail; or that the consumption of gas for heating by their agency will not increase rather than diminish. Indeed, it has been suggested in the "JOURNAL" that intelligent and tactful "town travellers" might do well in recommending gas-fires to the occupants of shops and chambers, very many of whom find coal-fires are a nuisance.

Here, however, we part company with Mr. Fletcher, regarded as the claimant for an "artistic" quality in gas-fires. Like most manufacturers of trade goods, he seems to imagine that the term "artistic" is synonymous with "costly," "ornamented," and "beautifully finished." It is difficult to show by verbal explanations that those who thus think miss the meaning of the word to which they give a mere "shop" signification. Their proposition is that, while a gas-fire finished in "thick smooth varnish" is not artistic, it has only to be finished in bronze or brass to become so. Put a few curly bits upon a gas-fire casing, and it becomes a "rococo," or a "Louis Quatorze" article. Say the word to the artistic designer, and he will convert the same elements to a "Queen Anne," or a "Gothic," or an "American Base Burner" style of architecture. Would it be a hard saying to lay down the proposition that a fire of a handful of sticks, burning in the hollow of three bricks, possesses a real beauty and an artistic value to which these dazzling gas-fitters' wares can never attain? Did anybody ever see a gas-fire included in an Arts and Crafts show? Until the essence of the matter is grasped, it is sheer waste of words to talk about the "artistic" aspect of anything. It was sufficiently shown in our former article what is the fatal weakness of the so-called gas-fire. It is gas; but it is not a fire. Its "fuel" is a sham; and it is damned beyond redemption, æsthetically.

It is quite true, as Mr. Fletcher says, that people like to see a fire as well as feel warm. Even in the best New York houses, although the cold is so thoroughly kept out by steam heat that the thermometers in the corridors stand well above 70° in "zero weather," the inmates like to gather round a blazing coal or log fire. It is not at all likely that the taste and sentiment which demand this tribute will be better satisfied with those electrical abominations mentioned by Mr. Fletcher than by the usual make of gas-fire. This well-deserved preference is the standard of artistic value by which we have appraised the gas-fire of commerce, only to find it wanting. It is also true that the British public do not like close stoves of any kind; so that it is useless to discuss the possibilities of gas as a heating agent in this retiring form. Manufacturers must, of course, make the goods that sell. It is not their part to try to lead customers the way they should go, unless they are trying at the same time to strike out a new line for themselves. Gas-fire manufacturers have no reason for discontent with their trade; and this solid consolation must satisfy them. Art is an insubstantial thing, after all. Ruskin and Morris were not good men of business. If they taught us a few things we know to be true, about Art and such-like uncommercial vanities, let us keep and ponder them in our hearts; for they will not sell.

### The London County Council Elections.

THE approaching London County Council elections have been heralded by the issue of the usual statements of policy on behalf of the opposing parties. If there is some hope of the relief of London, in March, from the incubus of Progressivism which has oppressed the ratepayers more or less ever since the first capture of this Authority by banded Socialists and Trade Unionists, it is obscured by the remembrance that Londoners are very prone to neglect their duty in self-government. Otherwise, the record of Progressive squandering and incapacity would effectually prevent the party from ever again being entrusted with the purse and the power of the County Council. We will not dilate now on the parliamentary record of the old Council, which is bad enough; but pages might be filled with its ineptitudes in other matters. It is to be noticed that the spokesmen and advocates of the majority in the Council plead their old blunders as a reason why they should be returned to power again—because they know now how to do the work better! This is the specific answer to the reproach that in their so-called "housing reforms" the old Council not only dispossessed more people than they afterwards accommodated, at enormous expense, but also took the wrong class of occupiers. This question of rehousing the population is certainly a pressing one, not in London alone; but that is no reason for entrusting with its solution men of the reputation of those who have turned municipal methods into a laughing-stock.

Naturally, a party in municipal politics who are content to put forward a quiet, businesslike, and frugal programme of administration, cannot compete in promises with those who will lightly engage to make a new world out of nothing, especially for the benefit of the working man. Happily, the still recent Metropolitan Borough elections showed that even Londoners are not always to be caught with chaff, and that ratepayers who find themselves bled more and more heavily every year to gratify the vanity of a set of busybodies, will sometimes take the trouble to mark their dissatisfaction at the polls. The chief difficulty in the way of making a protest of this kind effective, lies in the scarcity of the right kind of administrators for carrying it out. Men with affairs of their own to look after cannot spare the time to do the work of the town, which consequently gets left more and more to fussy nobodies and small professional politicians. The mass of detail which local authorities have to deal with drives the drudgery of the committee work into the hands of those who will do it, which means that the paid Trade Union official and his like are always "on the job," and the amateurs of Municipalism are led by the officials and other wirepullers. The outlook is not cheering; but almost anything would be preferable to an apathetic abstention of the electorate from the polls, which is quite within the range of possibility.

### Street Lighting and Building Frontages.

RETURNING to the subject of the lighting of the streets of London, we wish to take this opportunity of testifying to the superiority of the high-power incandescent gas-lamps which have now been extended eastward from the Wellington Street crossing with the Strand, to the corner fronting the church of St. Clement Danes, and beyond. It is along the north side of this stretch of the ancient way between London and Westminster that the demolitions for the new street have been commenced. There is a big hoarding here, covered with large posters, which naturally show a considerable expanse of white paper; and right opposite, a new very light-tinted stone building has just been disclosed to view. The combined effect after dark of so much white frontage, on both sides of the street, and the powerful gas-lamps in the roadway, is remarkably good. For the time, at this particular spot, modern architects have a chance of seeing what London might be made to look like at night, if only all the new frontages were made light-reflecting. Probably very few of them will notice it. Portland stone, warranted to get dingy in the shortest possible time, or dark terra-cotta, dingy to start with, will continue to rule the affections of architects; and another opportunity for the brightening up of our gloomy Metropolis will be thrown away. It is a great pity, more especially as the mischief is done chiefly through sheer want of thought. The very men who praise the cheerfulness of the buildings of Paris—far less interesting, on the whole, than those of London—fail to perceive that town frontages must be studies in black or white. The Parisian builders prefer white; we seem fonder of black. The air of Paris is not really so very much cleaner than that of London, although it has a certain advantage in this respect, due to the greater use of coke-stoves. Nevertheless, the old quarters of Paris are black enough. Our English cities might yet be redeemed from their usual gloom, if those who lead public taste in such matters would give a little attention to the matter of frontage colouring and light reflection.

### A Snub for Trade Union Officials.

IT reads strangely, on the face of it, that the shutting-down of a Welsh tinplate works, and the consequent throwing out of employment of between 600 and 700 workpeople in this industry, should have anything to do with the Gas Workers' Union. Yet the story reported to us of the "Deadlock at

"Cwmbwrla Tinplate Works" exhibits very strikingly the beauty of the organization of this Trade Union, and the kindred society of the Dockers. The trouble began with a trifling dispute over the work and wages of a few boys employed to bundle shearings at the mills of the Cwmbwrla Works, Llanelly, who belong to the Gas Workers' Union. The Company were disposed to meet the boys half-way; and they were willing to accept the terms "conditionally on "the sanction of Mr. Victor Morgan, of the Gas Workers' "Union, being first obtained." This potentate proved obdurate, repudiated what had been done, and "authorized the "boys, whose notices had expired, to come out on strike." The Works Manager is reported to have "suggested the "reference of the matter to the Conciliation Board;" but the great Morgan would not hear of it. The same magnate neglected to acquaint the officials of the Dockers' Union, who command the allegiance of 90 per cent. of the men employed at the works, of what was going on; nor did he deem it worth while to "consult the views of the Executive of the "Federated Trades Unions." Mr. Ben Tillett and Mr. James Wignell found this conduct inexplicable. To defy a mere employer were a venial error; but to fail of respect to themselves! Shocking! The members of the two Unions concerned held a joint meeting to discuss the situation, when Mr. James Wignell, Docker, expressed mild surprise at the behaviour of Mr. Victor Morgan, Gas Worker, and at his instigation a resolution was passed regretting what had taken place. This politeness was not reciprocated by the gentleman Docker, who told his brother official he did not know what he was talking about. Meanwhile, the employers prepared for action by posting notices to shut down the works, and clearing up stocks in hand. This spirited proceeding seems to have shown the red light to the valiant Trade Union officials, who composed their differences in view of the common danger, and waited in a body on one of the Managing Directors. There was the usual long talk—the palaver being protracted for hours, according to the newspaper report; but it ended in the unconditional surrender of the Unions, with an understanding that the original question should be submitted to the Conciliation Board. In addition, a new clause was agreed upon, to be included in the Conciliation Board agreement, to the effect that strikes must not be ordered in these small sectional disputes until the matter has been submitted to the Conciliation Board, and, failing settlement by this means, without a vote of the workpeople concerned "irrespective of the Unions to which "they belong." Another case of Jack-in-Office arrogance bringing the cause of Unionism into disrepute!

# WATER AFFAIRS.

## The Future of the London Water Supply.

In another part of the "Journal," we report the first portion of the discussion on the paper on the above subject read by Mr. R. E. Middleton at the Surveyors' Institution on the 10th ult., and given in our pages on the 25th. The author, it may be remembered, estimated that sixty years hence the population to be supplied with water in the Metropolis will have reached 19,500,000, and that the quantity which will then have to be provided, allowing 35 gallons per head, will be 717,500,000 gallons; and the object of his paper was to show from what sources this great bulk of water—half the average flow of the Thames—is to be procured. His statistics led him to the conclusion that it will be obtainable in the immediate neighbourhood of London, and that consequently resort to distant places, at vast expense, will be unnecessary. He thinks it will be quite sufficient when we number 15,000,000, and the population is growing, to begin to seriously consider whether London does or does not require any addition to its water which cannot be afforded by an extension of the existing works. This was an important pronouncement; but, coming from one who had assisted Lord Balfour's Commission in the inquiry which led to the conclusions they came to in 1892-3, it is entitled to be regarded as to a certain extent authoritative. It is on the above points that the discussion, so far as it has gone, has mainly turned. Will the sources contemplated by Mr. Middleton yield the quantity of water, and will the population grow in the proportion, he has assumed? These were the questions to be considered. Mr. Whitaker, speaking as a geologist, seemed to think that the author had rather over-estimated the water-bearing capacity of the chalk. He pointed out that the quantity got out of this source is sometimes only "a mere "fraction" of what goes in. As to the Thames, the safety of this supply depends, he says, upon its being "adequately "guarded;" and the guardianship is in fallible hands. Kent may possibly spare some water for its neighbours; but Surrey cannot do so. On the whole, he considers it will be necessary to look to areas outside the Thames basin for an extension of the supply. In the meantime, it behoves us to check waste, a great deal of which is preventible. He regards 35 gallons per head as excessive. Mr. Shaw, of Boston, thinks that with a supply of 30 gallons per head 10 per cent. is waste which could well be avoided. But consumers, as he says, have made up their minds that a "wasteful and extravagant" use of water shall prevail; consequently, water engineers have to reckon for it. He looks upon the Thames as the "sheet anchor" of the London Water Supply for generations to come, and believes the Lea will be equal to yielding the quantity of water assumed by the Royal Commission. As to the capacity of the chalk in the valley of that river to yield large quantities of water, he ventures to entertain a "modest doubt."

Professor Henry Robinson, who resumed the discussion on Monday last week, some years ago advocated the construction of storage reservoirs in the natural valleys of the tributaries of the Thames; and he considers this to be the solution of the problem of the London Water Supply. Professor Vernon Harcourt, however, speaking from a knowledge of the localities in which these great water receptacles would be situated, questioned the feasibility of carrying out the idea; and therefore he thought London should contemplate the possibility of having to go far afield for its water. Mr. H. H. Statham, the Editor of the "Builder," condemned the present system of supply as a "monstrous anomaly," and suggested 50 gallons per head as the quantity of water which should be provided. He advocated the use of meters for checking waste. An important contribution to the discussion was made by Mr. R. Hassard, the originator of the scheme for bringing water to London from Wales. He regarded the estimate of 15 millions of population in 1951 as illusory; 12 millions being nearer the mark, even if it should reach that figure. Consequently, 420 million gallons daily would supply this number of people with 35 gallons per head; and the Welsh scheme would provide it. Supposing the population not to exceed his figure, Mr. Hassard said the cost of the County Council's Welsh scheme would represent a capital outlay of £3 4s. 6d. per head, and would compare favourably with the cost of the Birmingham, Liverpool, and Manchester schemes. If the capital were borrowed at 3 per cent., and paid off in fifty years, London would have obtained its water at 2¼d. per 1000 gallons; and if at 2½ per cent., at 2¼d. If these figures will bear the test of critical investigation, Mr. Hassard was right in saying that the Welsh scheme would not involve the ruinous taxation people have been led to suppose.

Mr. Claude Baggallay focussed the attention of the meeting on the principal point of the paper—namely, whether London should not fully use the two rivers flowing through her midst before going elsewhere for water. In his opinion she should. As far as the Lea is concerned, Parliament has already decided that it is to be utilized to its utmost capacity. With regard to the Thames, it seemed to him, as it has done to others, that it will certainly be more economical to construct reservoirs as they are wanted than to incur expenditure on distant works which would not be remunerative for years. Mr. Lucas agreed with extending the storage accommodation, but thought the height of the reservoir embankments should be limited. While, however, concurring with the author's views on the former matter, he expressed the opinion that the time must come when it will be necessary to go to Wales. As Chief Engineer of an important Water Company in the Midlands, Mr. H. Ashton Hill's remarks were a valuable addition to the discussion. He pointed out the serious difficulty attending a scheme requiring so large a number of pumping-stations as the one propounded by the author, and characterized it as complicated, unworkable, and not justified by actual practice in the past. His personal familiarity with deep wells impelled him to more than doubt the practicability of the author's proposals; and he strongly supported a Welsh scheme, as furnishing London with "an "entirely independent string to its bow." As to its cost, if other large cities of the kingdom could afford to carry out gravitation schemes, surely the Metropolis should not, he

said, be deterred from doing likewise merely on the score of cost. Mr. Cowper-Coles, as an agent from the Welsh watershed, gave expression to some local views on the subject of the paper, and drew attention to the large amount of compensation which the carrying out of a Welsh scheme would involve. He expressed the hope that there would not be another Welsh Bill, as petitioning against these measures was a serious thing for the landowners. Moreover, he did not think Londoners would like the taste of Welsh water if they had it. In closing the discussion for the evening, Mr. W. Morris, the Engineer of the Kent Water Company, emphasized the advantage of carrying out a future water scheme by instalments. Mr. Walter Hunter, who is associated with Mr. Middleton in carrying out the Staines scheme, moved the adjournment of the discussion till next Monday, when an opportunity will be afforded for a further expression of views on this important question.

### Work of the Massachusetts State Board of Health.

It may be remembered that at the congress of the Royal Institute of Public Health held in Aberdeen last August, Dr. Percy Frankland expressed regret that there was not in England some such body as the State Board of Health of Massachusetts, for the purpose of carrying out investigations in connection with water supply and sewage disposal; and he suggested the creation of an Imperial Board of Health to undertake work of this nature. The advisability of constituting a new body need not now be discussed; but it may be of interest to glance at the work of the Board mentioned by Dr. Frankland, as recorded in their thirty-first annual report (for the year 1899), which has lately been published. It is a bound volume of 788 pages, and comprises a mass of statistical and other details. The Board consists of seven members, who have to assist them a Secretary, Engineer, Pathologist, Chemist, Consulting Chemist, and Analyst; and they deal with questions of water supply and sewerage, the inspection of foods and drugs, the health of towns, and disease and mortality. The first of the subjects here mentioned are those with which readers of the "Journal" are specially concerned.

It appears that some twelve years ago an Act was passed with the object of protecting the purity of inland waters; and under its provisions the Board have to be consulted with regard to the establishment of systems of water supply, drainage, and sewerage. During the year covered by the report, there were 79 applications for advice; and public inquiries were held in connection therewith. Chemical and microscopical examinations of the various water supplies of the State were continued as in previous years; and samples of water from 212 different sources were analyzed. At the close of the year, all the cities and 132 out of a total of 321 towns were provided with public water supplies. Under the provisions of an Act passed in 1897, the Board have authority to make rules, regulations, and orders for preventing the pollution and securing the sanitary protection of all streams and ponds used as sources of water supply, and the tributaries thereof. A very large proportion of the water furnished by public supplies throughout the State is drawn from surface sources, and used without filtration; and the Board emphasize the importance of protecting such sources from pollution by sewage or other filth. They are authorized to make rules and regulations with this object; and, in response to an application from the Metropolitan Water Board, they provided such as appeared to be required. They are given at length in the report.

Experiments upon the purification of sewage and water were carried on, as in previous years, at the Lawrence Experiment Station, to the valuable work done at which we have had occasion from time to time to refer. In the year dealt with in the report under notice, much attention was given to the septic tank system of treating sewage, which the Board consider gives promise, when taken in connection with bacterial or contact filters, of furnishing a means of purifying sewage in places where suitable land for the purpose is not available. Investigations upon the purification of water by sand filtration, which have been carried on at this station for some years, were continued. The Board say the further study of this subject brings out very clearly the importance of a careful attention to bacterial results, especially with reference to the character of the bacteria passing through a filter; and it indicates that determinations of numbers of bacteria only may fail to give reliable informa- as to the efficiency of a filter. This part of the Board's work is fully described by Mr. Harry W. Clark, their Chemist.

# ESSAYS AND REVIEWS.

## WAGES AND HOURS OF LABOUR IN 1900.

A preliminary summary of changes in wages and hours of labour during the past year has been issued by the Board of Trade. The following are some of the more interesting and important features of these statistics, which do not include any figures relating to agricultural labourers, railway servants, and seamen, as to which occupation returns are not yet available.

The year 1900 was pre-eminently one of rising wages. The upward movement, which began in the autumn of 1895, and continued without a break throughout the four succeeding years, culminated in the last year of the century in advances far exceeding in their total amount anything recorded in the period during which the Board of Trade have kept such statistics. The number of persons affected by the raising of wages was 1,088,300, or 13·8 per cent. of the estimated total number employed in all trades other than the three above mentioned, as compared with 1,175,576, equal to 14·9 per cent. of the total, in 1899. But although there was a slight falling off last year in the number of hands affected by the changes, in comparison with the previous year, the computed net amount of increase in weekly wages paid was more than twice as great; being no less than £203,240, or 3s. 9d. per head of those affected, as against £90,905, equal to 1s. 7d. per head, in 1899.

That is to say that, at the end of 1900, the wages-bill of the country was being calculated at a rate equal to £10,000,000 per annum higher than at the commencement, which does not, of course, mean that the working classes received £10,000,000 more in wages last year than in 1899. As rather more than half the net increase was obtained in the first half of the year, it is fair to estimate that the total of the wages paid in 1900 exceeded that of 1899 by well over £5,000,000, or (say) 3d. per week on the whole industrial population covered by these returns. Altogether in the past five years the annual wages bill of the country has risen nearly £25,000,000, in respect of increased rates alone as apart from increase of population.

The upward movement in wages, however, showed distinct signs of lessening before the end of last year. In certain industries, decreases were recorded in the later months which, in the annual statistics, are concealed by the increases which were granted in the early part of the year. For example, the manufactured iron workers in the West of Scotland, after receiving five successive advances, sustained a decrease in November; and in December some 8175 blast-furnace men (principally in the Cleveland district) had to submit to reductions under the terms of their sliding-scale arrangements.

As would be expected, the coal miners obtained the lion's share of the increased wages last year—in fact, they account for more than four-fifths of the total. Practically all (95 per cent.) of the workpeople employed in the industry obtained advances; the increments received being equal, at the end of the year, to £163,870 per week, or nearly 5s. per head. This amount is, however, only equal to about 9d. per ton of coal raised—a fact well worth bearing in mind by coal buyers. A table given shows the relation of the rates of wages being received at the end of 1900 by the miners in various parts of the country to the standard rates, and to those ruling ten years, five years, and one year ago. In every district the figures for 1900 are higher than at any previous time. The increase has been most marked in Scotland, where wages are now double the standard rates, whereas at the end of 1895 they were only 12½ per cent. above the standard. South Wales comes next, with wages 73¾ per cent. above the standard, against 12½ per cent. five years ago. For Northumberland, the figures are 61¼ per cent. and 7½ per cent. above the standard at the end of 1900 and 1895 respectively; and for Durham, 65 per cent. against 15 per cent. In the Federated districts, wages do not fluctuate so violently. On the 31st of December, the rates were only 50 per cent. in excess of the basis (increased on the 1st of January to 55 per cent., with another 5 per cent. to come at the beginning of February), while they were 30 per cent. above the standard at the end of 1895. The Federation miners, therefore, have the benefit of receiving better wages in slack times than their fellows; while the two 5 per cent. increases to be added to the rates obtaining at the end of the year put them, so far as percentage above standard rates is concerned, on a level with the Northern miners.

Next in importance to the changes in the coal mining industry are those in the iron and steel trades. The total advance in these industries last year equalled £14,440 per week, or rather more than 4s. per head of the 70,000 workers affected. Altogether during the last five years these workpeople have received increases in weekly wages equal to about 8s. 4d. per head.

Of the total number of workpeople whose wages were altered in 1900—namely, 1,088,300—no less than 1,035,300, or over 95 per cent., obtained their increases without recourse to a strike. This compares with 97 per cent. in 1899. As to the changes settled without a cessation of work, the largest proportion was decided by means of Conciliation Boards or by arbitration; rather more than one-third by direct negotiation between the parties; and about one-sixth by sliding-scale. Conciliation Boards had a larger share in the work than in the year 1899, owing to the

establishment of such a body for the coal trade of Scotland, and the re-establishment of the Northumberland Coal Trade Conciliation Board.

The changes in hours of labour in 1900 were rather more numerous than in the two immediately preceding years, but were not of a very important character—only affecting 55,560 workpeople. Of that number, 54,690 had their working time reduced by an average of 4·2 hours per week; while 870 increased theirs by an average of 1·6 hours per week. Nearly half the total were employed in coal mining. The principal change was that affecting 25,000 miners in Lanarkshire, whose daily hours of labour were reduced from ten to eight; while the number of days worked per fortnight was increased from ten to eleven—a net reduction of six hours per week. The bulk of the changes in hours of labour were arranged by direct negotiation between the parties or their representatives.

## GAS BILLS FOR 1901.

(*Continued from p.* 131.)

The Bingley Urban District Council Bill contains a part relating to the acquisition by the District Council of the undertaking of the Cullingworth Gas Company, Limited, which supplies a portion of their district. The purchase is to be effected by agreement or arbitration under the Lands Clauses Acts. Officers and servants of the Company in regular employ, but not including the Directors or ordinary workmen, are to be compensated for any loss of emolument due to the transfer. The greater portion of the district is already supplied by works belonging to the Council. An additional loan is required to defray the expenses of the transfer, and of the rearrangement of the purchased works in connection with the existing establishment, repayable in 50 years.

The Bradford Corporation Improvement Bill contains a clause to enable the Corporation to acquire additional gas lands. Further gas capital to the amount of £150,000 is required.

The Bury Corporation Bill contains clauses to enable the Corporation to appropriate certain scheduled lands to gas purposes, and to increase the gas capital by £1000.

The Colwyn Bay and Colwyn Urban District Gas Bill is to authorize the transfer of the undertaking of the local statutory Company, in accordance with powers reserved for the purpose in the Company's Act of 1896. The transfer is to take effect as from the end of the half year next following the arbitration. The Council are to buy all the moveable stock-in-trade and stores within 14 days of the date of transfer. Purchase money in arrear is to bear interest. Gas of 15-candle power is to be supplied at the maximum price of 5s. per 1000 cubic feet, tested on or within 200 yards of the works. Discounts up to 20 per cent. are proposed. The capital loan is to be repaid in 50 years. Surplus profits are to go to the district fund.

The Devonport Corporation (Gas) Bill is to enable the Corporation to purchase the undertaking of the Devonport Gas and Coke Company. Notice to treat is to be given within six months after the passing of the Act. In assessing the amount of the purchase money, the Arbitrator is to have regard to any moneys which have been distributed by the Company to the shareholders in excess of the authority of the Company's Act of 1853. The Manager and Secretary of the Company are to be compensated for any direct pecuniary loss suffered by them in consequence of the transfer. The Company are to carry on the undertaking in the ordinary way during the interval between the passing of the Act and the transfer; subject to inspection by the Corporation. Consumers' fittings are to be prescribed. Interest at 3 per cent. is to be allowed on deposits. In addition to the price of the undertaking, the Corporation propose to borrow £100,000 for gas-works extensions and improvements, repayable in 50 years. Surplus gas profits are to go to the district fund.

The Hartlepools Gas and Water Transfer Bill proposes the compulsory sale of the undertaking of the Hartlepool Gas and Water Company to the Corporations of Hartlepool and West Hartlepool. The Company have created and issued £400,000 share capital, and have a mortgage debt of £83,500. The purchase price is to be ascertained by arbitration under the Lands Clauses Acts; arbitrators and umpire to be appointed under the Arbitration Act, 1889. The Manager and Secretary of the Company are to be compensated if not retained by the Corporations. In addition to the other payments, the Company are to receive £200 for winding-up expenses. After the passing of the Act, the Corporation are to have the right of entry and inspection of the Company's working; but so as no unreasonable interference is thereby caused to the undertaking. A Joint Committee of the Corporations is to be constituted for carrying on the business. Members of the Joint Committee must be disinterested persons; but an interest in a newspaper which publishes the advertisements of the Committee, or as a shareholder in a joint-stock company doing work for the Committee, is not to disqualify members, except for voting in these respects. A penalty of £20 is attached to contravention of the terms of this section. A paid standing arbitrator is to be appointed to decide matters in which the interests of the Corporations are not identical. The interest on consumers' deposits is to be reduced to 3 per cent. There is to be no penalty for default of supply from unavoidable cause. Consumers' fittings are to be prescribed. Both Corporations are to raise money for the transfer, repayable in 50 years, and share the profits rateably.

The Heckmondwike Gas (Transfer) Bill is to constitute and incorporate a Joint Board for the Urban Districts of Heckmondwike and Liversedge, in the West Riding, and to transfer to such Joint Board the undertaking of the Heckmondwike Gas Company, incorporated under Acts of 1862 and 1875. The transfer is to be on terms to be ascertained under the Lands Clauses Acts. The maximum price of 14-candle gas is to be 4s. 6d. per 1000 cubic feet. There is to be no penalty for default of supply due to unavoidable cause. Gas capital, including £20,000 needed for extensions and improvements, is to be repayable in 50 years. Surplus profits are to be divided equally between the constituent authorities, or applied in reduction of the charges for gas.

The Honley Urban District Council (Gas Transfer) Bill is to transfer to the District Council the undertaking of the Honley Gas Company, Limited, who have an Order of 1886. The sale is to take effect as from Dec. 31, 1899, at the agreed price of £18,500. Outlying portions of the district may be sold to local authorities interested. The maximum price of 15-candle gas is to be 4s. 4d. per 1000 cubic feet. A surcharge of 10d. per 1000 cubic feet is to be made for the use of prepayment meters. Consumers' fittings are to be subject to inspection and approval. A gas-works improvement loan to the amount of £6000 is required. All gas capital is to be repayable in 40 years. Surplus gas profits are to go to the district fund.

The Mansfield Corporation Bill contains a part authorizing the Corporation to acquire compulsorily the undertaking of the Mansfield Woodhouse Gaslight and Coke Company. It is provided that the Company are not to do anything unnecessary or prejudicial to the Corporation before the transfer. The Company is a small concern with a paid-up capital of £1332 10s., and engaged in retailing gas purchased in bulk from the Corporation. Consumers' fittings are to be prescribed. The additional gas loan required is to be paid off in 45 years.

The Poulton-le-Fylde Gas Bill is to provide for the transfer of the undertaking of the Poulton-le-Fylde Gas, Coal, Lime, and Coke Company, Limited, to the Urban District Council. The Company obtained an Order in 1888, which contained a provision that if within 14 years the township should be made a local government district, the authority should have the right to acquire the undertaking by payment of the capital expended and an additional sum to be ascertained by arbitration failing agreement. The preliminary condition has now been supplied, and the provision is accordingly to be carried into effect. The amount of the purchase price is to be ascertained by arbitration under the Lands Clauses Act; and the stock-in-trade is to be bought within 10 days of the transfer. Consumers' fittings are to be prescribed. The maximum price of 16-candle gas is to be 4s. 6d. per 1000 cubic feet, with 20 per cent. discounts. Outlying local authorities are to be permitted to acquire their portion of the undertaking. The gas capital, including £5000 additional for works enlargement, is to be repaid in 45 years. All surplus profits are to go to the district fund.

The Shipley Gas, Tramways, and Improvement Bill contains a part relating to gas. An agreement between the Council and the Gas Company for the sale of the gas undertaking is scheduled for confirmation. The price of the property is £228,000, to which is added the amount of all the Company's credit balances and the value of the stock-in-trade. The Council pay the Company's Solicitors, and one-half of the winding-up expenses. The officers are protected. There is to be no excess price charged to outlying consumers. Discounts are to be allowed, up to 15 per cent. Consumers' fittings are to be prescribed. Outlying authorities may purchase their portions of the undertaking. The Council desire power to frame bye-laws and regulations for preventing misuse of gas or accident. The sum of £25,000 is to be borrowed for gas-works extension and improvement; all gas capital being repayable in 45 years.

The Wallasey Improvement Bill contains a part authorizing the Council to make a railway connecting their gas-works with the lines of the Mersey Docks and Harbour Board. This railway is to be in an existing road, and is to be made without spoiling the right-of-way. It is to be completed within three years, and worked by mechanical power. It is proposed to establish a superannuation or provident fund for employees of the Council, to which the Council may contribute equally with the members. The Council propose to borrow £4500 for the purchase of land and the construction of the proposed gas-works railway; and £45,500 for gas-works extension and improvement, repayable in 40 years. The financial part of the Bill contains what appears to be a novel proposal in relation to the repayment of the Council's loans. It is provided that the Council may at any time make a scheme for prescribing one or more uniform periods within which all or any future loans shall be discharged. This means a consolidated sinking fund. It is further provided that any borrowing powers possessed by the Council may at their option be exercised by making a requisition upon the consolidated sinking fund; thereupon the Council shall (*a*) withdraw from the fund the sum representing the amount of the borrowing powers proposed to be exercised in this way; (*b*) credit the accounts in the sinking fund with the repayment of a corresponding amount of the original charge which the fund was established to clear off—which portion of the principal indebtedness of the Council shall be deemed to be paid off accordingly; and (*c*) debit the statutory borrowing powers with the amount of the fresh appropriation, just as though the money

had been raised by the issue of a fresh security. The Local Government Board are to be kept informed with regard to the exercise of these powers by the Council; but the consent of the department is not requisite. Where the Council have any statutory borrowing powers, they propose to exercise them by granting mortgages in one form for all purposes, charged indifferently upon all the Council revenues and ranking equally without priority or preference. These mortgages are to be registered at the office of the Council, and be transferable for a fee of 5s. The state of the Council's finances at the present time is fully disclosed in a schedule to the Bill.

## TRADE DISPUTES IN 1900.

The Labour Department of the Board of Trade have published some preliminary figures relating to the strikes and lock-outs of last year. As readers are aware, 1900 was comparatively free from any very serious labour troubles, though not so fortunate in that respect as the record year 1899. So far as the number of disputes goes, last year had fewer than any of the seven preceding years—for which alone we have records—but the number of working days lost through the 623 disputes, involving 184,773 workers, in 1900 was $3\frac{3}{4}$ millions, as compared with $2\frac{1}{4}$ millions lost through the 719 disputes which rendered idle 180,217 workpeople in 1899.

The total wastage of time through labour troubles in the past eight years reached 82 million days, of which two-thirds were caused by six disputes alone; four taking place in the coal mining industry, and being responsible for the loss of $43\frac{1}{4}$ million working days. In other words, labour quarrels have been the cause of the loss of about ten full weeks' work of the whole of the collieries of the United Kingdom during the period in question, or a week and a quarter each year. Disputes are thus responsible for a greater loss of time in the mining industry than in any other; and to this general rule 1900 presents no exception. Of the aggregate duration of all disputes last year, 30 per cent. was due to the mining and quarrying industries—in spite, be it noted, of the fact that 1900 was one of the most prosperous years, if not the most prosperous year, in the annals of the coal trade. That percentage is, however, much below the general average for eight years, during which period disputes in this group of industries accounted for not less than 64 per cent. of the aggregate duration of all disputes.

Taking the total for eight years, the metal, engineering, and shipbuilding trades, next to mining, show the greatest loss of time through disputes; but in this group the figures for 1900 are far and away the lowest on record—the time lost being less than 3 per cent. of the total for the eight years. In the building, transport, and miscellaneous trades, the loss of time in 1900 was, in each case, above the average. Under the heading of transport, the days lost are given as 331,000, or 30 per cent. more than the total for the whole of the preceding five years. To this figure the Taff Vale strike largely contributed.

Of the total number of workpeople affected by the disputes of 1900—namely, 184,773—over 26 per cent. were thrown idle though not actually concerned in the quarrels. The number of persons indirectly affected is noticeably high in the mining, engineering, and textile trades. As to the causes of disputes last year, taking the total number of working days lost thereby, 67·2 per cent. were lost on account of disagreements over wages, only 1·3 per cent. on account of the question of hours, 21·3 per cent. over "working arrangements," 9·7 per cent. over questions of Trade Unionism and the employment of particular classes or persons, and the balance on account of other causes.

A larger percentage of disputes ended in favour of the men than in that of the employers last year; masters in a time of very active trade preferring to yield to unreasonable demands to keeping their works idle for any considerable length of time. The great bulk of the disputes were settled by direct negotiation between the parties or their representatives. Only 26 strikes and lock-outs, involving some 8177 workpeople, were brought to a termination by arbitration, conciliation, or mediation; these methods being, as in previous years, more utilized for the adjustment of differences likely to lead to stoppage of work than for the settlement of actual strikes.

The foregoing particulars are subject to correction in the annual report, for which we shall probably have to wait some nine or ten months. At the present time, a number of disputes commenced in 1900 are still unsettled, in which category the Bethesda trouble is apparently included, and cannot, therefore, be yet classified as to results and methods of settlement.

Sir F. D. Dixon-Hartland, M.P., has just been for the seventh time unanimously elected Chairman of the Board of the Thames Conservancy.

A report is current that the iron ore mines at Stank, near Barrow-in-Furness, the property of the Barrow Hematite Steel Company, will soon have to be closed. The one pit now working is to continue operations only so long as 1000 tons of metal can be thrown per week; and from this it is calculated that the "life" of the mine can at most be but two or three months.

## ELECTRIC LIGHTING MEMORANDA.

**The New Movement in Electric Engineering—Gas Companies not Admitted—Continental and American Enterprise—Mr. Wordingham on the Prevention of Electrolysis.**

It is a distinctly impressive sight, to see the strong movement that is actually going on among the various electric engineering firms doing business in this country, and taking more striking developments every week. During the past few days, there have been meetings of the Brush, the General Electric, and other Companies in a similar way of business; and at all these gatherings the same tale was told of big enterprises in hand and in prospect, for which the most extensive financial and other provisions are required. The Brush Company have practically amalgamated with the British Electric Traction Company; and the General Electric Company propose to hurry on the completion of new and extensive manufacturing works which will entail the creation of a large industrial settlement. Then there is the Westinghouse enterprise ripening; and the English branches of such important Continental firms as Ganz and Schuckert are making a brave show. There is very much in all this to make both steam engineers and the followers of the gas industry thoughtful. Of course, the trail of the financial serpent lies to some extent over the most widely-advertised electrical combinations; but, after allowing all the discount that can be legitimately deducted from advertising electricians' accounts of their own doings and prospects, the fact remains that the electric engineering business is fast becoming a very big thing indeed in this country. As Mr. J. S. Forbes told the proprietors of the Metropolitan District Railway the other day, those who are likely to be affected by this innovation in the industrial world must make their choice between sitting down and crying over it, or standing up to the inevitable.

So far as the outlook for British gas undertakings is concerned, it will be as well to recognize the stern truth that both law and public opinion combine to keep them strictly out of all participation in electrical enterprises. It was pointed out in these columns years ago that there are many places up and down the country where a little local electric lighting business might be very properly and conveniently done by the local gas company; and that probably, if the gas company did not provide this public service, the locality would have to go without it altogether. In all likelihood, if this new development had been permitted to the gas companies, these places would now be enjoying the advantages of electric tramways. As a matter of fact, nothing of the kind has been done anywhere. Whether through jealousy on the part of local authorities of gas companies, or through supineness on the part of the latter, gas people in this country are entirely "out of it" in regard to this interesting—one may say fascinating—branch of engineering work. We cannot but think it would have been to the advaniage of the gas engineering profession if all hands in its ranks had been compelled to learn how to handle electricity. Mr. Colson, at Leicester, had to do it, and did it very well. Other municipal gas engineers have done the same kind of work; but this has always been for the sake of the municipality, not for that of the gas undertaking.

If we look on the Continent of Europe, or across the Atlantic, we shall observe a very different condition of things in this field. Many Central European gas undertakings run electric branches for all purposes as a matter of course; nobody objecting. All that the public appear to care for is the cheapness and sufficiency of the service. They must be poor-spirited, ignorant people, dead to the voice of Progressive Municipalism as heard throughout this happier land. In the United States, the gas interest has simply appropriated the electric, somewhat by reason of the law of financial gravitation. In New York, the gas, the electric lighting, and the electric street tramways are in the same hands. The omnipresent United Gas Improvement Company, of Philadelphia, control the largest street railway investment in the United States, outside New York. There is no mildew, so to speak, on the directors and executive staff of this large undertaking. It is served in all grades by the best men to be had for money; and they earn the best money paid for similar work. That is what comes of running a gas business as a live concern, upon competitive lines, with as little red-tape at headquarters as may be. An interview with Mr. Walton Clark, and a little candid talk with him on the subject of the expansion of the Company with which he is identified, would do some of our statute-protected gas directors all the good in the world, if it did not harden them still more in their administrative petrifactions. Of course, the difference between American and English methods is radical. They manage a company by an organization which is at once administrative and executive. With us, gas directors have no such close connection with the working of the undertaking as American presidents, vice-presidents, and so forth. Our system suffers nonentities and incapables without entailing the wrecking of the concern; but in revenge it stifles business activity.

Mr. C. H. Wordingham has been invited to express his views on the question of electric tramways for large cities in the columns of the "Electrical Review;" and the result is an interesting article in the current number of our contemporary, in the course of which the vexed subject of electrolysis is touched upon. Mr. Wordingham remarks that the Board of Trade have laid down an arbitrary rule limiting the permissible drop of pressure in the tramway returns; but he declares that this is insufficient as a means of protection, and that unless this limit is substantially reduced in

practice the evil day of destruction of pipes is only deferred, and there will arise a condition of things in the future which will be like the American, where greater laxity has caused the evil effects to be sooner felt. If this is the prospect, it is all the more necessary that the problem should be faced now, instead of put off to a distant future when the damage shall have actually been done. It is reassuring to hear that Mr. Wordingham thinks the difficulties may be overcome in more ways than one. He writes with experience of planning out the supply of upwards of 100 miles of track, on the over-head trolley-wire system, having in it portions of extraordinarily dense traffic and involving risk to a "stupendous" number of main pipes. Mr. Wordingham frankly says that the consequences of electrolysis of these pipes, in any large city, are so appalling that the risk of such damage must be reduced to a negligible quantity. He has endeavoured to do this by the simple expedient—he calls it "the best, most convenient, and probably the cheapest way"—of providing a large number of centres of supply independent of one another so far as the tramway network is concerned. This means feeding the line and getting the return by stations (say) one mile apart, which would have the effect of reducing the rail conduction to half-a-mile at most. In this way, he finds the loss of pressure in the rails inconsiderable, which is, of course, the *desideratum*. Nobody has ever published an authoritative statement of the amount of unaccounted-for electricity in the case of a tramway traction system; but if there is no appreciable leakage from the rails, not much damage can be done. Mr. Wordingham's recipe for preventing this leakage appears to be a reasonable one.

## THE DUTIES OF AUDITORS.

The Companies Act, 1900, which came into force on the 1st inst., contains three clauses of considerable importance to the auditors of, and to everyone interested in, all limited liability undertakings; and, though not technically affecting them, to the auditors and shareholders of all other companies. These are the sections (21 to 23) relating to the appointment, the remuneration, and the rights and duties of auditors. The Council of the Institute of Chartered Accountants, recognizing the importance of a full understanding of these sections (which present several difficulties in their construction), have obtained the joint opinion of four eminent counsel; and with the text of the Act and of this opinion before us, it is possible to estimate the value of the amplification of the previously existing law relating to auditors.

The first of the three sections makes it obligatory upon every company to appoint an auditor or auditors, and provides that these auditors shall be chosen annually by the general meeting. In default of such appointment, the Board of Trade may, on the application of any member of the company, appoint an auditor for the current year. The section also provides that no director or officer of a company shall be eligible for the post of auditor. The second section in question determines that the remuneration of auditors shall be fixed by the company in general meeting. Auditors are, therefore, rendered so far independent of the directors of their companies that they cannot be dismissed, or have their remuneration reduced, by the directors, except with the consent of a majority of the shareholders.

It is, however, the third of the sections—namely, that relating to the rights and duties of auditors—which is of the most interest and importance. By this (the 23rd) section, it is provided that every auditor shall have a right of access at all times to the books and accounts and vouchers of the company, and shall be entitled to require from the directors and officers of the company such information and explanation as may be necessary for the performance of the duties of his office. The counsel consulted by the Institute of Chartered Accountants state that, in their opinion, the words "books of the company" mean all the books—not merely the books of account—and therefore include the minute-books and letter-books. Thus interpreted, the section gives the fullest powers of investigation to auditors, and, consequently, lays upon them the obligation of making their investigations as searching as possible.

Moreover, the section goes on to provide that the auditors shall sign a certificate at the foot of the balance-sheet, stating whether or not all their requirements as auditors have been complied with, and shall make a report to the shareholders on the accounts examined by them, and on every balance-sheet laid before the company during their tenure of office. Upon these provisions, counsel are of opinion that the word "requirements" is used in its popular sense, and not as referring merely to what the auditors are entitled to require under the preceding words of the section. Counsel further advise that, where the auditors' requirements are not complied with, the auditors should specify in their certificate the respects in which they have not been met.

The importance of this enactment is obvious. It places upon auditors, in the event of their having demanded, and failed to obtain, complete facilities for properly and fully investigating the affairs of a company, a legal obligation to divulge the fact to the shareholders immediately—that is to say, before the next annual general meeting. It will no longer be a matter for the exercise of discretion. Auditors will understand that to conceal any such hindrance to the performance of their duty would involve them in serious consequences should the affairs of their companies subsequently be proved to have been in an unsound condition; while the officers of a company will hesitate before exposing themselves to a charge of obstructing the auditors.

Section 23 finally enacts that, in every report to the shareholders, the auditors shall state whether, in their opinion, the balance-sheet referred to in the report is properly drawn up so as to exhibit a true and correct view of the state of the company's affairs as shown by the books of the company, and that such report shall be read before the company in general meeting. The first thing that strikes one on reading this provision is that the section contains no words laying upon the auditors any obligation to determine whether "the books of the company" exhibit a true and correct view of the state of the company's affairs. This must be considered to be a defect in the Act that would practically deny to it any value so far as defining the duties of auditors is concerned, were it not that, in the opinion of counsel, the words, "as shown by the books of the company," do not limit the auditor's duties to a comparison of figures. "No doubt," they say, "the auditor has to examine the books; but, as Lord Justice Lindley said in giving judgment in *re the London and General Bank*, he does not discharge his duty by doing this without inquiry, and without taking any trouble to see that the books themselves show the company's true position. He must take reasonable care to ascertain that they do so."

So interpreted, the definition of an auditor's duties is satisfactory; but it seems to us a perfectly stupid thing to put into a section words which the Courts have already held to express inadequately the requirements of the law, and which, if the section means what counsel say it does mean, are altogether superfluous. What more complete certificate could an auditor give than that contained in the words, "the balance-sheet referred to in this report is properly drawn up so as to exhibit a true and correct view of the state of the company's affairs?" We shall be much interested to see whether the Courts hold that the phrase "as shown by the books of the company" has no limiting effect upon an auditor's responsibilities.

As we have observed, these enactments do not directly govern the auditors of undertakings not formed under the Companies Acts; but, in so far as they represent a tightening of the reins of the law upon any auditors, they may be said to raise the standard of what the law expects of all auditors. We therefore hope that those who are entrusted with the examination of the accounts of any undertaking will consider whether their methods conform to the standard of thoroughness and rationality set up by the Act of 1900.

## THE GAS AND WATER STOCK MARKET.

**(For Stock and Share List, see p. 226.)**

The week just closed on the Stock Exchange was one that is better to look back upon than look forward to. Although there was not much outward sign of agitation on the surface, there was a sub-current of uneasiness; and people felt that they would not breathe quite freely until the settlement was over. Thus the tendency was fitful and uncertain from time to time; and things moved irregularly—dulness being the most prevalent feature. The funds were very flat. Consols touched 96½; and all the gilt-edged division drooped. Americans had a smart fall. Fortunately, the settlement was got through much more happily than it was feared might be the case; and there was no further hammering. Money was extremely abundant, which tended to facilitate the position; and discount rates were decidedly easier. Business in the Gas Market was quieter; the volume of recorded transactions being appreciably lighter than in the preceding week. The general tendency was firm. There were some noticeable movements in both the upward and the downward direction; but the variety was attributable to special causes. In Gaslights, the ordinary had a recovery of four points, opening at 95½ and closing at 99½. The withdrawal of the large parcel of £163,190 of stock which had been advertised for sale last Wednesday at the Mart initiated the advance; and it was aided by the announcement of a dividend at the rate of £4 8s. per cent., carrying forward £221,570. This carry-forward is some £28,000 more than that of the corresponding period last year; but the increase is more than counterbalanced by the reduction in the rate of dividend. The secured issues were pretty brisk; and they shared in the brighter feeling. South Metropolitan was more active; and prices looked inclined to rise. Commercial old was done once at top price, and then relapsed into quietude. In the Suburban and Provincial group, Brentford ordinary advanced; but the preference fell sharply on a parcel being let go at 130. Newcastle and Tottenham advanced; but the latter's debenture receded. The Continental Companies were quiet and firm; and there was no movement in the undertakings of the remoter world. Business in the Water Companies was not generally noteworthy.

The daily operations were: Gas was quiet on Monday; hardly anything being touched but Gaslight ordinary, which rose 1. Tuesday was more inactive still; but Gaslight ordinary gained 2 more. Tottenham debenture fell 3. In Water, East London rose 1. Wednesday was another quiet day, and nothing moved either way. On Thursday, the chief feature was a fall of 7 in Brentford preference. Tottenham "A" advanced 1. Friday was the busiest day of the week. Gaslight ordinary rose 1, Tuscan ½, and ditto debenture 2. Saturday was quiet but firm. Brentford rose 2, and Gaslight debenture ½.

# THE NEW GAS-WORKS AT SCHLIEREN, ZURICH.

(*Continued from p.* 144.)

E.—Electrical Station, Heating, Lighting, and Workshops.

(Figs. 29, 30, 33—37.)

It has already been said that steam is necessary for working a gas-works. It is employed for six engines in the machinery building, for heating the gasholder cups, for the centrifugal machine for the tar, for the ammonia works, for the carburettors and vaporizers, and lastly for the baths and warming of all the buildings. Steam was, therefore, clearly indicated as the power raiser, as far as breeze and coke-dust (bye-products of little value in gas making) could be utilized for heating the boilers. Power is thus obtained very economically; and it allows of the parallel working of boilers, which is not possible with the simultaneous use of gas and steam engines. The excellent results obtained by a similar installation of boilers at the Limmatstrasse Gas-Works, and the Rorschach hydraulic elevator works, persuaded us to make the power station of steam. The Rorschach works also use breeze and coke-dust. It was calculated that a heating surface of 180 square metres (1937 square feet) was required in winter for a make of 60,000 cubic metres (2,118,000 cubic feet) of gas. The consumption of steam is about 45 to 50 per cent. less in summer than in winter, owing to there being no heating of the buildings and gasholders. Two Lancashire boilers, with 90 square metres (968·7 square feet) of heating surface, were put up. One suffices for the work during the summer; while both are necessary in winter. A third is in reserve. The boiler-house is built so as to allow of a fourth boiler when the works have to be enlarged. A chimney, 51·6 metres (169 ft. 3 in.) high, stands behind the building. (See figs. 29, 31, 35.) The heating by coke-dust is done by means of a grate on the Kudlicz system. A Worthington pump and an injector are used for feeding the boilers. This pump sucks the water directly from a well at a distance of about 30 metres (about 98 feet), or from a supply reservoir in the boiler-house; while the injector draws the water only from the reservoir. A water-meter on the Schmid system measures the feeding water.

Two horizontal tandem compound steam-engines are enough for a daily make of 60,000 cubic metres (2,118,000 cubic feet) of gas. Their normal power is from 70 to 80 horse, at 135 revolutions per minute. Sufficient space has been left for a third steam-engine of 200 to 250 horse power. These two engines drive by belts a main common line of shafting, which works in turn, also by belts, two triphased, alternate current dynamos, each of 50 kilowatts. Each dynamo can work on to the power and lighting systems. The tension on the former is 220 volts; while it is only 120 volts between the phases of the latter. The two motors can be coupled in parallel during the time of heaviest working (fig. 33). The two present engines will serve later on as a reserve for that of 250-horse power; while during the winter months one of the engines of 70-horse power will be enough for the lighting. In the middle of the central power station will be noticed the distribution board, from which 24 underground cables leave for the different feeding points for light and power. Two small electric motors, each of 8-horse

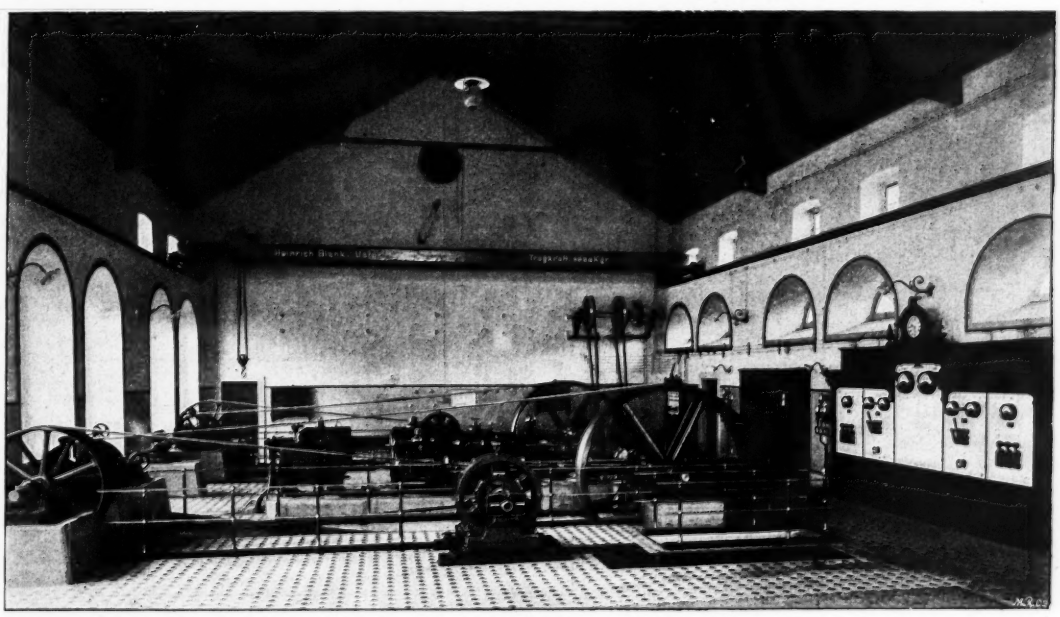


Fig. 33.—Engine-House.

power, with transmission for driving the pumps, are placed in the south-west corner of the house. One motor is sufficient; the other being in reserve.

The rooms for the laboratory, photometer, recording tablets, and stores, as well as the w.c. for the machinery staff, are placed against the west wall of this building. On the south side there is a concrete tank, from which the water of condensation is drawn either by air-pumps or by a suction-pipe about 50 metres (164 feet) long, or, lastly, when the level of the underground water is particularly low, directly by simply opening cocks. This tank is fed by a special pipe coming straight from the tower reservoir. Up to the present, 23 motors—representing a total of 207-horse power—have been fitted; the smallest being estimated at 1·5, and the largest at 15 horse power. The boiler-house and the central power station are connected by an accessible underground channel, in which are put the different main-pipes for steam, water, electric current, &c. Fig. 36 is a section of the subway. Two other equally useful passages lead to the well—one along the boiler-house, and the other slantingly facing the pumps. The suction-pipes of the feeding apparatus for the boiler-room, pumps, and steam-engines are also placed in the subway. This facilitates the looking after and up-keep of these pipes, which are so important to the general working.

The workshop building of one storey is adjacent to the north side of the boiler-room. On the ground floor, it contains two large rooms, one of which is used for the forge and the other for fitting and repairing. The first floor serves for the carpenters, joiners, and painters, and also as a store. An electric motor of 5-horse power works the drilling machine, lathe, circular saw, grindstone, and ventilator.

*Heating.*

Except the coal-stores, retort-house, and coke-building, all the houses are heated by steam from the boiler-room. The heating apparatus consists of a principal steam-distributing arrangement, which is placed in the boiler-house (fig. 37). The actual pressure of 8½ atmospheres is lowered to 2 atmospheres (the usual heating pressure) by a reducing-valve. Two chief circuits start from the central distributor. One of them heats the rooms of the superintending staff, the workmen's quarters, and the baths; while the second supplies the steam for all the other buildings, as well as for the gasholder cups. Also supplied by the heating steam are the injectors on the Körting system, which are used to pump out the water from the three pits of the coal-store elevators, and the discharging hopper. The main-pipes are well isolated in the passages between the buildings, and are placed underground in cement pipes, in two parts, of 40 cm. diameter (15·75 inches). The expansion of these long steam-pipes is provided for by means of copper expansion-pieces, placed in easily accessible openings. The pipes themselves are of drawn iron. The warming of the rooms is done by simple radiators. This installation for heating will be sufficient for the finally completed works.

*Lighting.*

The works are lighted by the electric light and by gas, both made on the spot, which means that they are cheap, and at cost price. The moving of railway waggons being very important in winter, safety of working necessitates good lighting of the lines, of the discharging points, and of the coke-house. This lighting, as also that of the yard, is by arc lamps. Incandescent electric

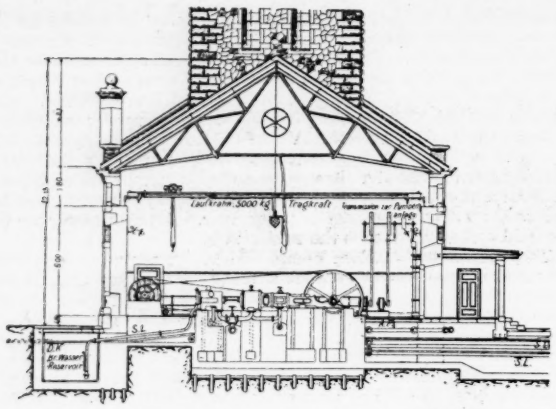


FIG. 34.—CROSS SECTION OF CENTRAL POWER STATION.

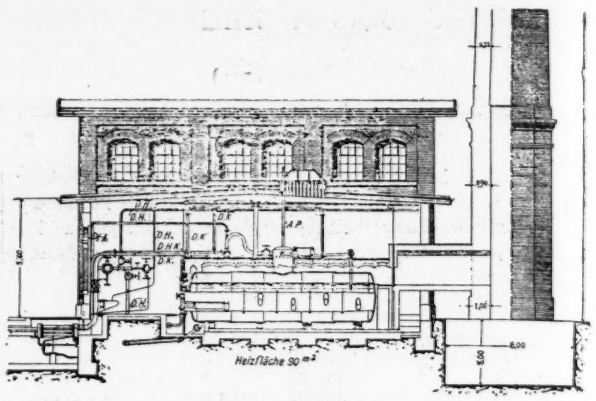


FIG. 37.—CROSS SECTION OF BOILER-HOUSE SHOWING THE DISTRIBUTION OF THE STEAM FOR THE HEATING APPARATUS.

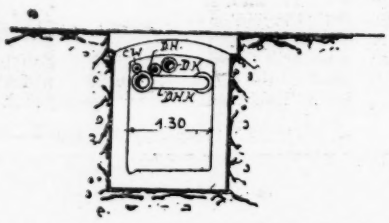


FIG. 35.—ENLARGED SECTION OF CONNECTING CULVERT.

| | |
|---|---|
| Laufkrahn 5000 kg. Tragkraft . . | Five-ton Travelling Crane. |
| Transmission zur Pumpenanlage. | Gearing to Pumping Plant. |
| Br. Wasser-Reservoir . . . . | Works' Water Tank. |
| A.P. S.L. . . . . | Exhaust-pipe. Suction-pipe. |
| C.W. . . . . | Condensed Water Main. |
| D.H.K. D.K. . . . . | Principal Steam Pipe (for power). Steam Pipe (for power). |
| D.H. . . . . | Steam Pipe for heating purposes. |
| Heizfläche 90 m². . . . . | Heating surface, 970 square feet. |

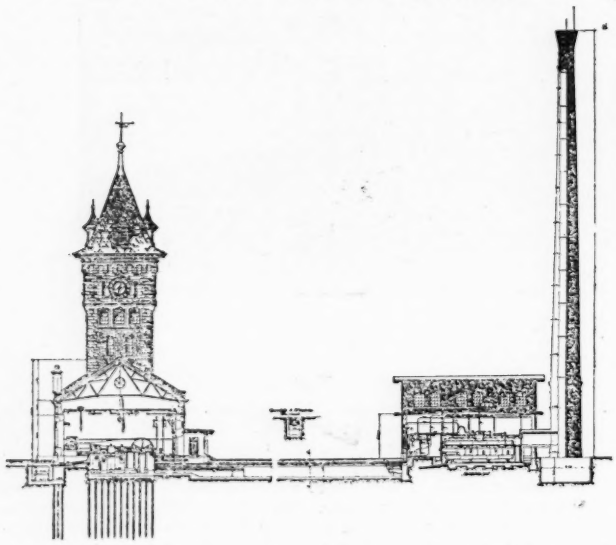
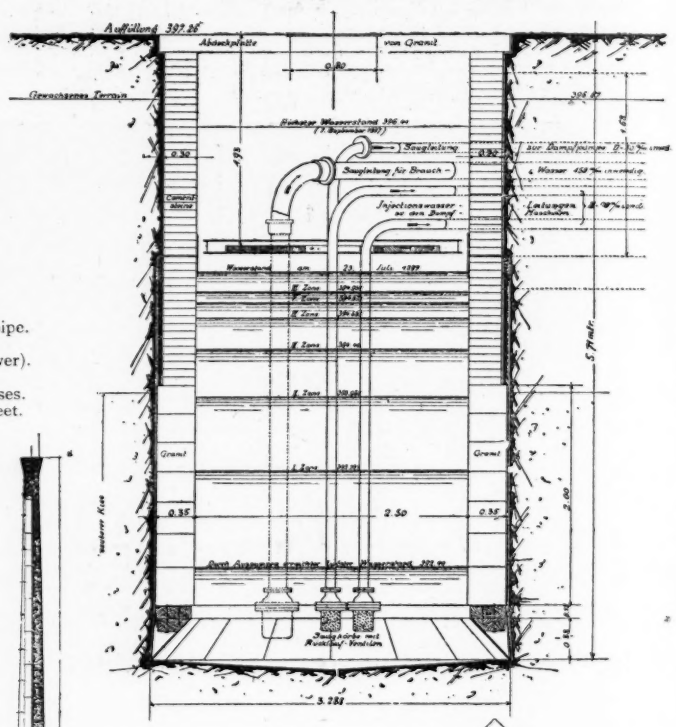


FIG. 36.—CENTRAL POWER STATION AND BOILER-HOUSE.



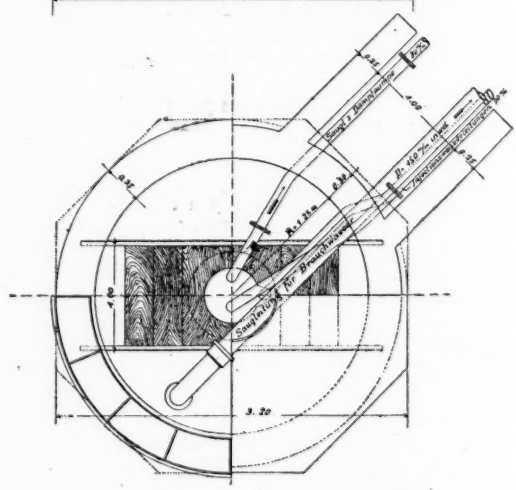


FIG. 38.—PUMPING PIT. Scale 1 : 60.

| | |
|---|---|
| Abdeckplatte von Granit. . . . . | Granite top-slab. |
| Saugleitung zur Dampfpumpe, 80 m/m. | Suction to steam-pumps, 3⅛ inches internal diameter. |
| Saugleitung für Brauchwasser, 150 m/m. | Suction for works water supply, 6 inches internal diameter. |
| Injectionswasser-Leitungen zu den Dampf-Maschinen, 90 m/m. | Injections to steam engines, 3½ inches internal diameter. |
| Saugkörbe mit Rücklauf-Ventilen . . | Pump-strainer, with return valves. |

lamps are only used in the underground passages of the coal-stores, in the subways, and in the apparatus rooms, so as to avoid all danger of fire and explosion. All modern works are lighted in this way. Incandescent lighting, either by electricity or by gas, is put up so as to have in any case one light in reserve. Contact lamps, which do not cause any sparks, are used for the inside lighting of apparatus and pipes, in case of repairs or cleaning. There is a total of 49 arc and 281 incandescent lamps, 6 contact lamps, and 90 gas-burners, which are never all lighted together.

### F.—WATER, DRAINAGE AND DRAINS, WORKMEN'S QUARTERS, BATHS, &c.

The works are provided with two different water supplies—one for drinking, the other for works purposes. The underground water in this part of the Limmat Valley could not be used for drinking. On account of the site on which the works have been built having been used for some years as a depôt for the rubbish from the town of Zurich, the water in the subsoil is found to be contaminated by unwholesome infiltrations, which has also been

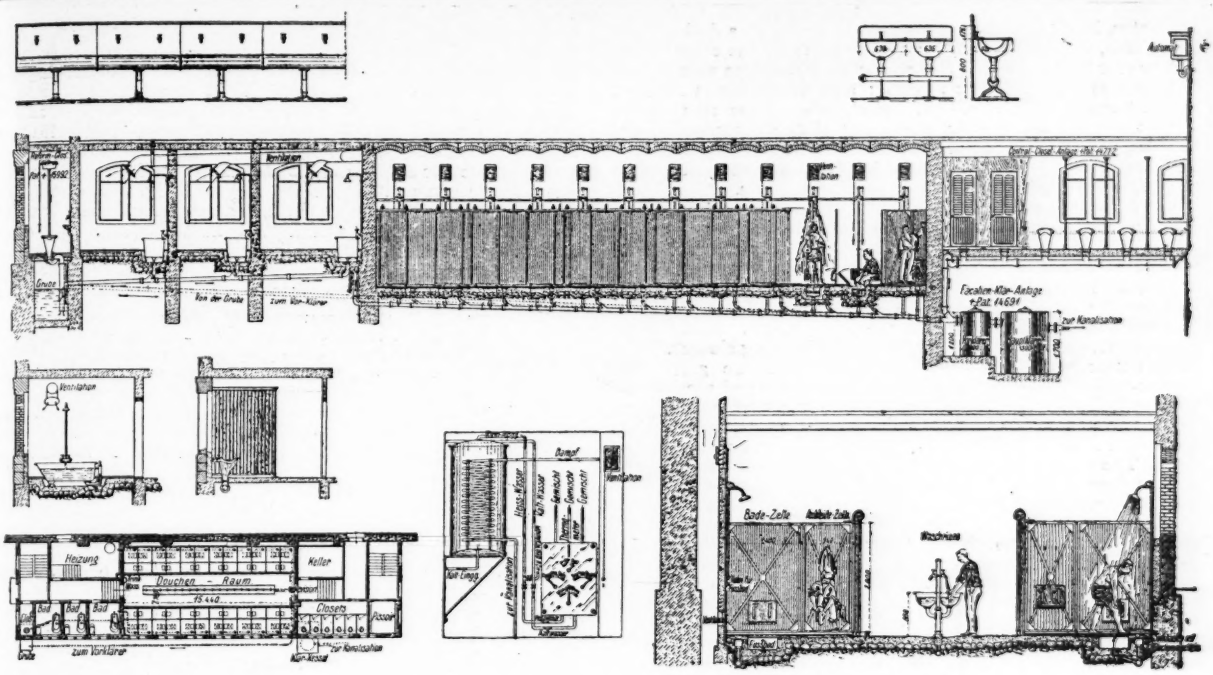



FIG. 39.—CLOSETS AND SHOWER BATHS. Scales { Longitudinal section, 1 : 180. Plan, 1 : 60. Cross section, 1 : 125.

shown by chemical analysis. It contains a large proportion of organic matter—such as saltpetre, ammonia, chlorine, &c. A filter would have been very expensive, and probably inefficient. The proposal to bring the water from Zurich had also to be given up, in view of the cost of the main, and the difficulties in passing the Commune of Altstetten. Proposals were made to the Commune of Schlieren, which has an excellent water supply. As these came to nothing, the town laid down, at its own expense, a 120-mm. (4¾-inch) pipe, starting from the crossing of the Baden line (North-Eastern Railway), over the old route to Engstringen. This main finishes in the middle of the works yard, and measures 800 metres (875 yards) in length. The pressure is 6½ atmospheres; and besides supplying drinking water, it also gives what is required to the hydrants in case of fire. Water from the Schlieren source would be too dear, and not plentiful enough, for the industrial operations of the works. The works, when entirely finished, will use, as has already been said, 500 cubic metres (about 110,000 gallons) of water per day for manufacturing purposes.

A well has been sunk in the middle of the yard at a certain distance from the buildings, so as to avoid the undermining and sinking that sometimes happen in such cases. This well has a depth of 6 metres (19·68 feet), and an inside diameter of 2·5 metres (8·2 feet). The granite masonry is strengthened at its lower part by a very strong cast-iron ribbed crown, which will render the deepening of the well easy, should the water ever be short. This, however, seems hardly likely, after our experiences up to the present. The underground water is very abundant, as is shown by the following table :—

| Min. | Zone. | Litres. | Gallons. | Min. | Zone. | Litres. | Gallons. |
|---|---|---|---|---|---|---|---|
| 1 = | I. = | 4336 = | 954 | 4 = | IV. = | 1396 = | 307 |
| 2 = | II. = | 3332 = | 733 | 5 = | V. = | 833 = | 183 |
| 3 = | III. = | 2131 = | 469 | 6 = | VI. = | 490 = | 108 |

A constant output of 3000 litres (660 gallons) per minute can be maintained without lowering to any extent the water-level, when this is normal. The chemical composition of the water allows of its use for directly feeding the boilers, provided that a certain quantity of soda be added to it. Up to the present, no incrustations—not even of the slightest kind—have been observed in the "Standard" washer. The cost of raising this water is comparatively very small.

*Drains and Draining.*

These are used to draw off rain and dirty water from the whole works. The special schemes and plans were made by both the Town Architect's Office and the gas-works. The Water Cantonal Office was able to supply useful information, thanks to observations which had been made for some years as to the levels of the River Limmat. The gas-works on their own account had also made during two-and-a-half years exact daily statements on the underground water-level. An extraordinary flood of the Limmat, on Sept. 7, 1897, raised the water-level up to 396·41 (metres above sea-level), and covered the ground around the middle gasholder. This was a fresh proof of the utility of the raising proposed by Councillor Süss. It will be remembered that the ground-level was raised 75 cm. (29·5 inches). The surface served by the drains is, in round figures, 7·11 hectares (17·57 acres). The dirty water is in small proportion, compared with that from the rain. Its amount may be reckoned as corresponding to a fall of water of 10 mm. (say, ⅜ inch). The works level is at a height of 397·30 m., with a slope in the direction of its main centre line of 1·5 per thousand—that is to say, about the same slope as that of the Limmat. The Limmat at high water reaches 396·40 m. in front of the last turntable of the railway. The small difference of 90 c.m. (35·43 inches) between the water-level and that of the works, offered unfavourable conditions for draining. The part of the works under cover has a surface of 3·61 hectares (8·92 acres); that uncovered, 3·5 hectares (8·65 acres)—or a total of 7·11 hectares (17·57 acres).

Allowing a fall of water of 143 litres (31·46 gallons) per hectare (2·4711 acres) and per second, we have the amount of water as follows :—

| | | |
|---|---|---|
| Covered surface | 3·608 h. × 143 l. = . . . . | 517 litres. |
| Uncovered surface | 3·500 h. × 30 l. = . . . . | 105 ,, |
| | Total . . . . . | 622 litres. |

Supposing there was a continuous rain of 10 mm., there would be a total of 70 litres (15·4 gallons) to take off. A supplementary outlet has been made at about 50 metres (164 feet) from the mouth of the channel into the Limmat, which can discharge 1 cubic metre (220 gallons) of used water. The curve taken from the statement of observation on the maximum and minimum water-levels, shows that the floods which surpass the average water height are of short duration, and do not occur more than fifteen days in the year.

The lowest point to be served by the drains is found at the height of 395·10 metres. It is in the workmen's building, where the discharge from the baths and lavatories has to be taken away. A steam-injector is used to raise the water from these drains at the time of floods. The principal drain is protected against floods by a valve. The pipes are laid so as to be able to enlarge them without trouble in the direction of the Limmat; their extension could only be of advantage to the drainage of the works. The drainage of the water inside the works is effected by two channels of oval section, 0·70 mm. by 1·25 m. (2·29 feet by 4·1 feet), placed right and left of the principal centre-line, and which discharge themselves into the main channel of 0·90 m. by 1·575 m. (2·95—5·16 feet), about 100 metres (328 feet) above its outlet into the Limmat. The earthenware drainage pipes, with concrete openings, which discharge into the oval channels, can be cleaned out, as is necessary owing to their slight fall. The settling-tank, placed near the water-tower is 38 metres (124·67 feet) long, and 26 cubic metres (918 cubic feet) in capacity. The distribution of the water is done by means of valves, of a section of 0·60 m. by 0·75 m. (23·62—27·56 inches). This tankis filled from that in the water-tower. Up to the present, this installation has given very good results.

*Workmen's Quarters, Baths, and Closets.*

Two buildings have been arranged for the workmen in the works. The principal one is against the retort-house, and is used by both day and night stokers. This has an upper floor, so that the entrances from the ground floor and the drawing stage are on the same level. The following conveniences are found on the upper floor: A washstand for the stokers' use before their meals; a kitchen, with different gas-stoves; a room containing all the requisites in case of accidents—bed, operating table, and all the

apparatus, instruments, and remedies for first aid; a dining-room for 70 men, with 36 cupboards; and an office for the chief stoker, and two for the foremen. The ground floor contains urinals with eight places (on the Beetz system); and water-closets in eight compartments, with automatic water-flush. Some steps lower down there is a set of baths, consisting of 24 shower-sprays and cubicles, which are made of galvanized corrugated sheets. The whole rests on timber-work raised 8 cm. (3·15 inches) above the ground, so as to allow of cleaning the cubicle floors.

The shower is separated from the dressing compartment by a door in corrugated sheeting; and the outside doors hang on rollers on a thin rod. This arrangement allows several doors to be opened at the same time, without blocking the passage. The shower-bath cubicles are provided with foot-baths in enamelled iron, together with take-off and overflow pipes. The seat for the foot-baths is a bracket one, with automatic return. Each dressing compartment has a seat, and a peg for hanging clothes. The cubicle floor is covered with a moveable pitchpine grill. The shower-taps are opened by pulling a light chain, and are shut off automatically on leaving go of it. In the middle of the open space left by the two rows of cubicles is a washstand in white enamelled iron, 12 metres (over 39 feet) long, with 36 basins and taps. The ventilating and taking away of the steam and vitiated air are done by hinged windows, and by twelve vents, ending in isolated channels, and rising above the roof, which are ventilated by six of Dr. Wolpert's exhausters. The water from the baths flows directly into the drains; while that from the closets runs into a clarifying apparatus, which decomposes the fæcal matter by water, and thus allows its being led directly into the drain. Cleaning out is by this means avoided. This system has been adopted in some new school buildings in Zurich, and is well known as being excellent. Besides the shower-sprays, three complete bath-rooms have been put up. The heating-chamber, with a mixing and regulating cylinder for the bath water, is in front of these three bath-rooms.

Having a bath is compulsory for the retort-house staff and stokers. Each man is entitled to a piece of soap and a towel. The workmen had already recognized the advantages of baths in our old Limmattstrasse Gas-Works, where, however, they were much less satisfactorily organized. It is no longer necessary to make washing compulsory, as, thanks to the modern installations at the Schlieren works, all the men have understood the absolute necessity of it. The capital sunk in this department has not only been profitable to the gas workers generally, but also to their families. The good influence arising from being obliged to be clean in the works, is without doubt spread among them.

A second dining-room, situated on the ground-floor of the elevator building, is specially set apart for the labourers and the railway staff. Fifty men can comfortably have their meals in it; and each has a cupboard for his belongings. The room is well warmed and lighted.

*(To be continued.)*

## WATER DISTRIBUTION.

An experience of nearly a quarter of a century in the distribution of water should entitle an engineer to speak with certain authority on the subject, and should place him in a position to give some useful hints to pupils preparing for the profession of water engineering, as well as to others actually engaged upon works. In publishing the little book we are about to briefly notice, Mr. J. A. M'Pherson has given evidence of a desire to occupy this position;* and a perusal of its contents shows that he is qualified to fill it. In the course of 150 pages he has presented much information which will be helpful to the student or the candidate for examination. The matter is divided into five chapters, which are preceded by a few remarks on the sources of water and its storage. In his first chapter, the author deals with the general arrangement of the supply to a district; in the second, he gives some notes upon distribution; in the third, he furnishes details of the method of laying out mains; in the fourth, pipes and fittings are described; and the last is devoted to meters, the measurement of water, and regulating and recording apparatus. Having procured his water (Mr. M'Pherson appears to favour upland water brought by gravitation to the spot where it is to be consumed), he first describes the simplest form of supply—viz., to a district of even level—and then a district on two levels. He deals successively with service reservoirs, water-towers, district pumping-stations, and aqueducts or pipe-lines; and the chapter, which is illustrated by eleven diagrams, closes with some notes upon the hydraulic gradient. The next chapter consists of some general remarks on the sizes of the leading and distributing mains for various classes of residential and manufacturing districts, and the arrangements made for street-watering and fire-extinguishing purposes. The author offers some remarks upon the influence of levels on main areas, and discusses the positions and depths of pipes. He gives 2 ft. 6 in., and in cold and exposed districts 3 feet, as the minimum depth at which pipes should be laid. The succeeding chapter is devoted to the practical details of the method of laying out a system of distributing mains for a typical district of 60,000 inhabitants, two-thirds of which would be served from the low-level reservoir, and the remainder from a high-level tower—the supply being 25 gallons per head. This is a very useful chapter; the example taken being illustrated by a large folding chart as well as by several diagrams. In this connection, the author deals with the various formulæ for the velocity and discharge of water and the arrangements for controlling its distribution. The chapter devoted to pipes and fittings is the longest in the book; and it is very fully illustrated. So is the concluding chapter, on meters and the measurement of water. The author is clear and concise, and his matter is accompanied by no less than 19 diagrams and 103 illustrations, so that no difficulty should be experienced in understanding him. Reference to the different subjects dealt with is facilitated by the provision of an index.

* "Water-Works Distribution. A Practical Guide to the Laying Out of Systems of Distributing Mains for the Supply of Water to Cities and Towns." By J. A. M'Pherson, Assoc.M.Inst.C.E. London: B. T. Batsford; 1900.

## PERSONAL.

Mr. Andrew M'Nair has been appointed Manager of the Strathaven Gas Company, Limited, in succession to his brother, Mr. H. M'Nair, who has been appointed Manager of the Renton Gas Company.

The Directors of the Market Weighton Gas Company have appointed, out of 82 applicants, Mr. Herbert Legge, at present Assistant-Manager of the Hertford Gas-Works, Secretary and Manager of the Company, in place of Mr. Ernest W. Wright.

Mr. W. H. Price, second assistant and late pupil of Mr. J. W. Helps, of Croydon, has been appointed Engineer and Manager of the Reigate Gas Company. Upon relinquishing his appointment at Croydon, Mr. Price was presented by the Engineers' staff with a pair of binoculars, as a mark of respect and esteem, accompanied by all good wishes for his future welfare.

## OBITUARY.

A gentleman who was known to a large number of gas managers has lately passed away; Mr. James Slight, of the firm of Messrs. Slight and M'Kimmie, cannel coal merchants, of Glasgow, having died suddenly on the 11th inst.

We regret to record the death last Thursday morning, in his 58th year, of Mr. James Brooks, who was for fifteen years Gas Engineer to the Midland Railway Company—a position which he resigned in April last on account of ill-health. Prior to obtaining that appointment, deceased was for something like a quarter of a century with the Derby Gas Company, during the last ten years of which he had charge of the outdoor department under Mr. Charles Taylor, the Engineer. He leaves a widow, two daughters, and a son.

By the death of Dr. William Sedgwick Saunders, which took place last Friday, at his residence in Onslow Gardens, S.W., the Corporation of London lose the valuable services of the Medical Officer of Health and Public Analyst. Dr. Saunders was some years ago in private practice in the City, and became a member of the Corporation. On the death of Dr. Letheby in 1874, he was chosen as his successor. He was the author of several important works on subjects connected with public health; among them being "Reports on the General Sanitary Condition of the City of London," "On Some Chemical Analyses of the Waters from the Surface Wells in London," and "The Action of Water on Lead Pipes."

At the advanced age of 91, there passed away last Wednesday Mr. Henry Williams Chisholm, formerly Chief Clerk of the Exchequer, who held the office of Warden of the Standards from the date of its creation in 1867 until 1877, when he retired on completing 53 years of public service. Under his direction, the Standards Department was raised to a prominent scientific position, and furnished with the best instruments essential for accurate verification. On his retirement, the title he had borne was no longer used; and the present occupant of the office (Mr. H. J. Chaney) is called the Superintendent. Mr. Chisholm was for upwards of 35 years one of the Auditors of the Gaslight and Coke Company, and only retired a year ago, owing to ill-health consequent upon advancing years. He was the author of a book on "Weighing and Measuring;" and he contributed to "Temple Bar" a series of articles entitled "Recollections of an Octogenarian Civil Servant," in which he gave an account of the work of the Exchequer in the early part of the Nineteenth Century. He recently presented to the Treasury his continuation of "The Great Account," from 1868 down to the present time; the work not having been officially kept up to date. Deceased was a skilful musician, and used to play first violin in the Civil Service Amateur Orchestra.

In the "Technology Quarterly," Mr. W. L. Smith gives the results of his experiments with certain shades and globes for electric lights as used in interior illumination. For a shade to be satisfactory, it should soften down and distribute evenly the light of the naked lamp, while, at the same time, it should not absorb too great a proportion of it. His experiments show that this problem is solved by very few of the shades in ordinary use. He finds that the "Holophane" shades, in which the cutting of the glass is determined on scientific instead of artistic principles, are greatly superior to all others.

# NOTES.

### A Cheap Machine-Shop Lubricant.

A recipe is published by the "Ironmonger" for the preparation of a cheap workshop lubricant, which may be employed with machine tools and in other ways to the saving of oil. Into a petroleum barrel or suitable tank place 14 lbs. of soft soap and 7 lbs. of common washing soda, to which add 30 gallons of water. To dissolve this mixture, it is necessary to boil it, which can be conveniently done by making an old half-hundredweight, or other mass of iron, red hot in a gas-retort or over the forge, and dropping it into the liquid. It will require several such applications to thoroughly boil up the whole mess; but a labourer can do all that is necessary in an hour or two, and the result will be a lubricant cleanly in use and costing less than 1d. per gallon. It will keep any reasonable time. There are many uses for which a lubricant of this character is really more suitable than oil, especially on account of the ease with which the work can be wiped when completed. The trouble of dripping oil is also avoided by this means.

### A Concrete Church.

It is with very great satisfaction that building constructors of advanced modern views respecting the desirability of making the fullest use of cheap and approved materials, will hear that Mr. C. H. M. Mileham, a London architect, is building a large church at Plumstead, chiefly of concrete. This interesting structure has been illustrated in the "Builder," and forms a striking evidence of the truth that not all British architects are copyists and stylists. The church, dedicated to St. Mark, is to be built on the north side of Plumstead Common, with an extensive range of ancillary buildings—men's institute, parish hall, class-rooms, and parsonage. It will accommodate more than 1300. The architecture is of a very simple, round-arched character. The walls will be made of concrete, with inner and outer skins of rough brickwork, and a very sparing use of stone. The whole building will be covered with concrete vaulting; a plain barrel to the nave, and Roman intersecting vaults to the aisles. The barrel vault of the nave will carry an outer roof of fir purlins and rafters, covered with pantiles. All the other vaults will be covered with asphalte.

### Hints for the Drawing Office.

Professor Beresford Pite recently addressed the members of the Architectural Association on the preparation of sketches and drawings. These hints are reported in full in the "Builder" for the 12th inst. With regard to the choice of paper for drawing-office work, Professor Pite strongly advocated the use of good, hard paper and the avoidance of a cheap article. He recommended Whatman's or unbleached Arnold. The O.W. papers are good; and so are Joynson's. It is essential that drawing paper should bear scraping. Sixpenny pencils are insisted upon, not too hard. Professor Pite counselled students not to be afraid of using the india-rubber. Crow-quill mapping pens he condemned; preferring Edinburgh Fine Points. He preferred stick to bottle ink. Erasures should be made with the best and hardest ink-eraser. Attempts at washing or scratching out ink lines usually fail. Generally speaking, Professor Pite was all for using the best materials in a drawing office, if the most satisfactory work is to be the product. He confessed the charm of working out a drawing thoroughly well, but seemed to hint that it does not often pay. In finished drawings, particular attention should be given to the lettering, the style and execution of which proclaims the character of the draughtsman more than anything else. As to mounting drawings on strainers, Professor Pite strongly dissuaded draughtsmen from attempting to do this kind of work in the office—advising that it should be left to the picture-frame maker. Professor Pite should have added the warning to make the writing on plans bold enough, especially if there is any chance of the drawings being copied by a photographic process.

### The Flow of Water in Pipes and Channels.

Writing in the "Engineering Record," Mr. Chas. H. Tutton, of Buffalo, discusses the comparative accuracy of different formulæ for giving the flow of water in pipes and channels. These formulæ represent various theories. The first is the formula $V = C \sqrt{R S}$, which is the fundamental formula of a legion of authors, who seek to adjust it to the facts by making the coefficient C variable. Here R is the hydraulic radius, or the area of the water section divided by the length of wetted perimeter. On the assumption that the resistance to the flow of water arises wholly from the frictional resistance offered by the wetted sides of the channel, it is the measure of the number of particles of water that are retarded by a unit of perimeter. S is the slope of the water, the total fall divided by the total length in which the fall occurs, or $h \div l$. This, in a natural channel, is practically the sine of the slope; but is very seldom so in a pipe. The writer shows that the theory underlying this first formula is incomplete, because, while the other elements are rigid, C, the coefficient intended to give the effect of the character of the surface, is too variable. There is another theory of fluid motion, represented by the formula $V = C\ R^{\frac{2}{3}}\ S^{\frac{1}{2}}$, in which C is a constant. This assumes that the head remains constant; but its effective work is reduced to suit the demands of the roughness of the perimeter. The writer states that for pipes this formula gives close results.

# COMMUNICATED ARTICLE.

## REGULATING THE AIR SUPPLY TO BURNERS CONSUMING MIXED COAL AND WATER GAS.

By H. Leicester Greville, F.I.C., F.C.S., &c.

The Nineteenth Century has been an era of unsurpassed progress. To review in the briefest possible manner all that has happened, even in the limited domain of the development of the gas industry, would require the publication of at least a small treatise, in place of a brief article, in order to adequately represent the fullest importance of so large a subject.

Omitting minor considerations, there cannot be a doubt that the introduction of carburetted water gas on a large scale has been a distinct and radical change from the older procedure of the manufacture and supply of plain coal gas. Much might be said on this subject; but in the present article I have simply to offer a few remarks on one aspect of the question, and this a most important one—viz., that of the suitable regulation of the air supply to gas under the modified conditions of manufacture. Progress in the manufacture of water gas has been so rapid that the altered conditions necessary for heat and light development have not progressed at the same rate; so that at the present time the best means of obtaining the maximum effect possible have not been fully realized.

The circumstances are peculiar. Gas companies (acting with due consideration to the interests of themselves and their consumers) have adopted a radical change in manufacture. The new gas has been proved by scientific tests to be fully up to the statutory illuminating power as authorized by the official method prescribed by the highest experts. With regard to its heat value, the present mixture of coal gas and carburetted water gas is practically equal, or at least very little inferior, to plain coal gas.

Notwithstanding these scientific facts, it is undoubtedly the case that, in districts where carburetted water gas has been adopted as an adjunct to coal gas, there have been, in many instances, unsatisfactory developments from a consumer's point of view. Gas-stoves, and even Welsbach burners, have started "roaring" or "flashing-back." This is entirely due to the fact that the air supply has been adjusted for the coal gas previously in use, before the advent of water gas, and that neither the makers of heating nor of lighting appliances have recognized the need of radical but necessary alterations. The fault is not with the gas, but with the appliances for its use. In fact, it seems that the attitude of the purveyors of gas appliances might suggest that the old proverb—"Where ignorance is bliss 'tis folly to be wise," should be modified, as a practical application, to—"Where wisdom is bliss 'tis folly to be ignorant."

Comparing the composition of coal gas with that of water gas, the following figures have been taken as a basis. The authority is Professor Vivian B. Lewes, quoted by Herr Henri Sospisio, of Trieste, in a paper read before the International Gas Congress at Paris, and published in the "Journal" of Sept. 18, 1900. I give the figures verbatim.

| | Ordinary Gas. | Carburetted Water Gas. |
|---|---|---|
| Hydrogen (H) | 47·69 | 39·44 |
| Marsh gas ($CH_4$) | 35·75 | 16·99 |
| Hydrocarbons ($C_nH_{2n}$) | 4·88 | 8·23 |
| Carbon monoxide (CO) | 5·99 | 29·03 |
| Carbon dioxide ($CO_2$) | — | — |
| Nitrogen (N) | 4·76 | 6·20 |
| Oxygen (O) | 0·95 | 0·21 |
| Lighting power in candles | 22·3 | 22·7 |
| Density (air = 1000) | 549 | 647 |

It would have been better to have contrasted a lower quality of coal gas with the higher quality of water gas; but for my special purpose, the comparison as it stands is sufficient.

The first step to ascertaining the proportions of air necessary for complete combustion, is to show the nature of the chemical changes involved. These are as follows (taking the $C_nH_{2n}$ as $C_2H_4$):—

$$2\ H_2 + O_2 = 2\ H_2O$$
$$CH_4 + 2\ O_2 = CO_2 + 2\ H_2O$$
$$C_2H_4 + 3\ O_2 = 2\ CO_2 + 2\ H_2O$$
$$2\ CO + O_2 = 2\ CO_2$$

The proportions by volume of oxygen necessary for combustion, for 1 volume of the respective gases, are, from the above formula: H requires of O, 0·5 vol.; $CH_4$, 2 vols.; $C_2H_4$, 3 vols.; and CO, 0·5 vol. Calculating on these formulæ, and on the composition of the respective gases, we have the following figures:—

| | Coal Gas. | Oxygen Required. | Carburetted Water Gas. | Oxygen Required. |
|---|---|---|---|---|
| H | 47·67 × 0·5 | = 23·83 | 39·44 | 19·72 |
| $CH_4$ | 35·75 × 2·0 | = 71·50 | 16·99 | 33·98 |
| $C_2H_2$ | 4·88 × 3·0 | = 14·64 | 8·23 | 24·69 |
| CO | 5·99 × 0·5 | = 2·99 | 29·03 | 14·51 |
| Total oxygen required for complete combustion | | 112·96 | | 92·90 |

The net result showing that, whereas 100 volumes of coal gas require for complete combustion 112·9 volumes of oxygen, the

proportion for carburetted water gas is 92·9—a net difference of 20 volumes, which, multiplied by 5 (taking the proportion of oxygen in air roughly as one-fifth) is equal to 100 volumes difference in the air supply for the two gases. On a basis of 50 per cent. of coal gas and water gas, the calculation would indicate that the air supply would be 50 volumes in excess of that required for coal gas only. It is therefore obvious that, on the most abstract scientific reasoning, burners manufactured on the basis of developing the best effects from coal gas would have an enormously excessive air supply when used for water gas, or even water gas and coal gas containing a large proportion of the former. Alterations in the respective volumes of the two gases would naturally modify the figures, but would leave the scientific basis of the matter untouched.

The practical effects of an excessive air supply are well known in scientific circles, although not sufficiently recognized. Burners intended to develop their maximum light from limited combustion, in which dense hydrocarbons are temporarily formed—such as flat flames and even argands—do not develop their maximum possible light; while with regard to heating burners especially designed for the best conditions of immediate and perfect combustion with the production of non-luminous flames, such as characterizes those used for heating stoves, and for the Welsbach incandescent burners, the proportions of air and gas come rapidly close to the point of absolute explosion. The first indication of this critical condition is the production of a roaring sound, resulting from a series of small and rapidly successive explosions. The least further excess of oxygen then has the effect of what is popularly known as a "flash-back," in which the explosive mixture of gas and air can no longer maintain even its disturbed equilibrium at the burner-outlet, but flames down the tube and ignites the gas-jet at the burner-inlet. Long before the period of the roaring or flashing-back occurs, the air supply may have been in excess of that necessary for the production of the best effects, *quo ad*, the respective ratios of gas and air.

The remedy for this state of things is of so simple a character that it is a matter for wonder why the purveyors of gas appliances have not seriously considered the matter before. Possibly they were in ignorance of the requisite scientific data upon which to act. All that is necessary to meet the emergency is a limitation in the area of the holes regulating the air supply. In the case of Welsbach burners, the difficulty can be met in a simple way—viz., by slightly enlarging the small orifice which acts as the gas-inlet. This can be done without necessarily increasing the consumption, which can be controlled as usual by the supply-tap. A difficulty in the practical application of "old" and "new" gas might be suggested by the fact that the two different grades require, for the development of their best efficiencies, different ratios of gas and air supply. This apparent complication could, however, be easily overcome.

With regard to one large application of gas—its use for stoves for cooking and heating purposes—two classes could be issued by the manufacturers, designated by some brief but distinctive title, such as "A" and "B;" the one class being intended for districts where coal gas alone is supplied, and the other for areas where carburetted water gas has been adopted. It would not be difficult for gas companies to place orders for either class to meet their special requirements. As to the special question of the supply of water gas and the possible increase of its use in the future, the necessary modifications for its complete combustion in order to produce the best effects have, I hope, been clearly indicated.

With regard to the employment of gas in flat-flame burners, the necessary modification to produce the best effects would be to employ burners with large holes, with a slow initial velocity of gas. It might be within the province of the present article to discuss, or to criticize, Mr. Dibdin's recent and painful experiences of the variations in illuminating value which he has obtained by subjecting gas of varying composition to the process of combustion in unsuitable burners, and noting, with the highest expenditure of scientific accuracy in photometrical practices, and elaborately designed diagrams, the eventual results. It has, however, been so long recognized as a fact that the so-called candle value of any particular gas depends on the conditions of testing, that any remarks on the subject are almost superfluous.

Mr. Dibdin assumes that the gas should be made to suit the burners, whereas the whole previous record of scientific research has been in the direction of making the burner suit the gas. A professional man may, in pursuit of his avocation, be called upon to test any grade of gas, within the possible variations of from 10-candle coal gas to as high as 60-candle oil gas. No scientific man with an accurate knowledge of his profession, and unprejudiced by bias, would dream of testing gas of different compositions and of varying illuminating power by the same burner; and where this has been done, even to a limited extent, no one can be expected to manifest either the slightest surprise at the results obtained, or the most limited enthusiasm on their publication. The methods explain the results. It is not, perhaps, judicious to jest over such a serious matter; but Mr. Dibdin's allegations against the carburetted water-gas industry (and his figures practically amount to this) reminds me of one of the "Ingoldsby Legends," in which the following couplet occurs—

> Never was heard such a terrible curse;
> But what gave rise to no little surprise
> Nobody seemed one penny the worse.

In conclusion, I can only say that I believe there is a large future for carburetted water gas. There are many reasons for its more extended adoption; and there is no doubt that, with a full recognition of the most advantageous methods of its combustion in order to produce the best effects of which it is capable, many prejudices will be dispelled, and it will take its right place—useful and economical alike to producer and consumer—as one of the leading features of the age in scientific progress.

# TECHNICAL RECORD.

## POWER GAS AND LARGE GAS-ENGINES FOR CENTRAL STATIONS.

The discussion on Mr. H. A. Humphrey's paper on the above subject was continued, before a considerable audience, at the House of the Institution of Mechanical Engineers last Friday. The greater part of the paper and of the discussion on the occasion of its reading was published in the "Journal" for the 18th ult.

Professor F. W. Burstall (Mason College, Birmingham) expressed his admiration for the way in which Mr. Humphrey had carried out the difficult work of experimenting on such large gas-engines. No one who had not had the experience of conducting a test on an engine of 100 to 200 horse power knew the difficulties that were to be encountered with a gas-engine as against a steam-engine. Personally, he was much gratified that Mr. Humphrey had put them in possession of these data—data which he was perfectly certain did not exist anywhere else. There were two points on which he (Professor Burstall) should like to remark; and the first had reference to the method of governing. Mr. Humphrey and, he believed, many of the gas-engine makers were of opinion that governing by throttling was not possible with engines using a weak gas. This was, he (the speaker) thought, due to the method of ignition which was usual in this country. The hot-tube ignition, when working with a weak charge and with a low compression, was extremely difficult to ignite; and if electric ignition was used, it must be used with a spark of large dimensions. The trouble that was met with in governing by reducing both the air and the gas was almost entirely due to this difficulty: if they attempted to ignite with an ordinary tube as they came down in the load, the engine missed fire. Even with electric ignition, a result was obtained that might be shown on the blackboard. [Explanatory diagrams were drawn on the board; and, without them, Professor Burstall's subsequent remarks may appear ambiguous. But the drift of his argument may be gathered.] The only thing, he said, that could be done was to alter the lead of the igniting spark. It was necessary to make the spark pass as much as ·7 of the stroke, in order to get a correct ignition of the charge. He imagined that the failure to ignite when governing by throttling on the weak gas was almost entirely due to the ignition. Of course, taking into account the number of thermal units which were present in a cubic foot of the mixture, it was quite immaterial for ignition purposes whether one was working with 3 to 1 of weak gas or 10 to 1 of rich gas. The second point he should like to say something about was the change of economy which came in when the gas charge was cut down. The changes he alluded to were those purely on the indicated power. The brake power was most important from a commercial point of view; but from the research point of view, the matter depended purely on the engine employed. If they started the engine wheel operation with the richest possible charge, and then proceeded to cut down the amount of gas, a steady rise in economy would be found until a certain point was reached. [The Professor then roughly drew an average indicator diagram on the board—one curve lying above, and another lying below.] The curve lying below, he remarked, was a curve plotted on the ordinary assumption of constant specific heat; it was a curve which showed that the gas was expanding without heat being either added or thrown out. The curve above was one which was plotted on the assumption of a variable specific heat; and it was also a curve in which heat was neither gained nor lost. One curve apparently showed the charge was gaining heat, which was, of course, the expression of "after-burning" or "slow combustion," which led to the numerous disputes of ten or twelve years ago as to what exactly happened. The other curve showed the charge was losing heat throughout the whole stage of its expansion. The combustion was probably entirely finished at the point of maximum pressure. There were, however, cases when actual after-burning could be got. That was, when the charge was extremely weak and the burning was slow. According to the theory of thermal dynamics, such a gas should yield inferior economy, because the heat was not all added at the maximum temperature. He was gratified when applying the author's tests to his own work to find that very weak charges were not so efficient as some of those yielded before. It was gratifying when one found theoretical results borne out by experiment.

Mr. Walter Dixon (Glasgow) congratulated Mr. Humphrey upon his careful and laborious work, as well as upon the fact that he had been able to bring before the members a subject which, in its entirety, was only possible at this date, and was wholly new—that was, a combination of large-power engines and producer

gas in practical work. His (Mr. Dixon's) own association with this matter was important in a way, inasmuch as he was connected, so far as the electrical work was concerned, with what he believed were absolutely the first experiments in this class of work—viz., the experiments which Mr. Thwaite carried out at Wishaw, near Glasgow. These, he (the speaker) believed, were the first, though they were followed very closely on the Continent. But, in a way, the results were almost identical with those now before the members. They were experiments carried out on the utilization of producer gas—the producer being in that case a blast-furnace, and the gases further were subjected to the extraction of the bye-products. In those experiments they came to a dead-halt, because they were not able to get, at that date, a thing they had to-day—that was, a large gas-engine. The experiments, as the first of the series, were, so far as they went, remarkably successful; and the question then arose, Here is producer gas—not Mond—how can we use it? The matter was taken up by himself and others; and they inquired where they could get large gas-engines. They could obtain them, five or six years ago, of 100-horse power; and some makers were then experimenting with engines of 200-horse power. Two years after, there was another matter in which he was interested (a scheme which was practically the same thing as they were now discussing—for a large Colonial works); and, again, the question came to a dead-halt on the same point—there were no large gas-engines available. About the same time that Mr. Thwaites' experiments were carried out, experiments were proceeding on the Continent at two different works. Whether it was significant or not of caution in this country, their Continental friends were certainly two years ahead of them; and two years ago they had the means of publishing what here we were now only able to do, and which Mr. Humphrey had done in his paper—viz., the results of experiments on large power gas-engines. As he had read the paper, he thought in a way a little injustice was done to the cause, or rather to the subject of the paper. As one read it, one got the idea that the main point of it was that they now had producer gas—producer gas which could be used economically. That was not the new point in the paper at all. Producer gas had been available for years. The point which they should not lose sight of, and which was the new one, was that they could now get large gas-engines. Nobody felt more delighted than he did, seeing he had been on the track for five years, that he could now get large gas-engines. It would be a mistake to get an impression that the producer was the main part of the paper. On the other hand, some injustice was done—some wrong impression was given—in making such a large point of the producer gas, and especially of the Mond gas. The subject was now such a practical one that the paper and these results would get into the hands of parties who had hitherto not had to deal with producer gas. Situated as he was in and among iron and steel works, he knew that producer gas was a thing of every-day occurrence; but if this paper went into the hands of their central station engineers and so on, it would give them a wrong impression. It would give them the idea that "Mond" was the only pebble on the beach. He was not the only pebble on the beach, though the number was limited. He (the speaker) thought it was an injustice to Mr. Humphrey himself to have pinned the whole thing on the Mond producer gas, because it was not the only gas available; and his opinion was the paper would rise in its merits very largely if the word "Mond" could be more or less deleted, except perhaps in the last clause of the paper. Then the paper would attain a standard of national importance. At present there was a tendency to think the author might be running a fad, which he was not. Mr. Dixon proceeded to criticize some of the author's figures in relation to electric lighting work, part of which, he said, would give the impression that there had been a little tendency to make the producer figures appear better than they were. But they must not lose sight of the fact that they had a very important matter before them; and it would be a pity to envelop the subject with petty criticism. The point to be learnt by everybody using power and using steam was that there were now gas-engines of large power; and that they had by their combination with producer gas—Mond or other gas—a system by which they could produce power with 1 lb. or 2 lbs. of the commonest coal—slack—and get back the value of the coal in bye-products.

Mr. Dugald Clerk (London) also congratulated Mr. Humphrey on his very able and meritorious paper; and he did so most sincerely because he had some critical remarks to make in regard to the subjects dealt with. In making these remarks it must not be understood that be depreciated in any way the important work which Dr. Mond and Mr. Humphrey were engaged on; and he agreed that the work was exceedingly important. He (the speaker) took the view, and had long taken the view, which Dr. Mond had now adopted, that the gas-engine was the engine of the Twentieth Century. During the last 26 years, the gas-engine had sprung up from nothing. When he first had to do with gas-engines 24 years ago, the largest was a little "shooter" engine made by Messrs. Crossley, in which the piston was shot out of a cylinder, and where the maximum power possible was three-horse. This was supposed to be a huge engine in those days of 1876. The Otto engine—the compression engine—came into use in this country in 1878. Few gas-engines were then employed. But gradually the size of the engine increased, until at the Kilburn show in 1879, where he (Mr. Clerk) exhibited his first compression engine, the largest gas-engine was a monster of 16-horse power. In those days, it was called the "King" of gas-engines (Laughter); but it really was a very huge affair for a gas-engine then. After that time gas-engines went on steadily increasing in power, until the difficulties which were due to increased dimensions began to be apparent to the constructors. However, before he said anything of the difficulties of large power engines, he wished to consider the work that Dr. Mond had associated himself with, more particularly in conjunction with Mr. Humphrey—that was, the Mond gas producer. He quite agreed with the last speaker that other gas producers existed, and that producer gas, in fact even so far as water gas, was no new thing in this country. But he wanted to consider from the paper what was the nature of the advance which Dr. Mond claimed to have made, and what was the nature of the actual advance he (Mr. Clerk) believed he had made. He differed from Dr. Mond and Mr. Humphrey in some respects; but he agreed in others. Dr. Mond had attacked a very difficult problem. The problem was how to make a gas producer which would produce a good gas, and at the same time recover the ammonia completely if possible from the gas so produced. Now this was a difficult problem, because the conditions which were proper to the production of good gas were to a great extent antagonistic to the production of the ammonia—that was to say, if one wished to produce good gas, the best thing to do with the producer was to work at a much higher temperature than the temperature at which Dr. Mond was at present working. One of the interesting points about the Mond producer was the very low temperature at which the carbonization was conducted. Mr. Humphrey was good enough to show him (the speaker) over the works at Winnington the previous week; and he had the pleasure of inspecting both the producers and the two gas-engines driven by them. To recover the nitrogen of the fuel, it was necessary to take care that the temperature of the ammonia evolved on the decomposition of the coal was not high enough to decompose that ammonia, and make it into nitrogen and hydrogen again. Therefore, it was important to keep down the temperature in the producer. To do this Dr. Mond very ingeniously flooded his producer with an excess of steam—something like, he believed, two-and-a-half times the weight of steam to the fuel gasified. It was two-and-a-half times greater than the weight of fuel gasified. The consequence was he had to make arrangements to recover a proportion of that heat, or else the producer would be very uneconomical. He had, in addition to the air which was passed through an ordinary producer together with a little steam, to pass enough steam to keep his temperatures within the required limits and to wash and carry away the ammonia produced without decomposition. Dr. Mond did this in a very ingenious and able way, and he succeeded in large extent in getting good gas and a good deal of ammonia. But so far as he (Mr. Clerk) had been able to understand the figures (which he had gone into very carefully), Dr. Mond had not succeeded by any means in getting what he should call high efficiency in a producer. In one respect, Mr. Humphrey's figures were confusing. He did not say for a moment they were misleading, because the author had been so exceeding careful and correct; but he thought the way in which he had put the figures was a little misleading to one reading the paper carelessly. The efficiency of the Mond producer was given in the paper. There it was said: "The calorific value of the total gas made as a percentage on the calorific value of the total fuel gasified is 84·1 per cent." This conveyed to a person reading the paper for the first time the idea that Mr. Humphrey was claiming for the producer an efficiency of 84·1 per cent. But, on careful perusal of the paper, this did not appear to be so. The 84·1 per cent. was Mr. Humphrey's estimate of the proportion of the heat obtained by burning the gas produced compared with the total heat evolved if the fuel had been turned directly to heat in the producer. But in Mr. Humphrey's earlier paper before the Institution of Civil Engineers in 1897, he stated that he required for every ton of fuel gasified in the producer about ¼ ton—he (Mr. Clerk) thought it was a little less—of added fuel to produce the steam necessary to add to the producer. The consequence was the real efficiency of this particular producer was the proportion of the heat produced on burning the gas to the total fuel, *plus* the fuel used to produce the necessary steam for operating the producer. This brought out the efficiency to something like 67 per cent., which was below the efficiency of other producers which did not attempt to recover the ammonia. In addition, Mr. Humphrey made the suggestion that the exhaust gases of the gas-engines would give heat enough to produce this steam without added fuel. That might be so; but it was not the proper figure to take in dealing with the efficiency of the producer, because other things could be done with the exhaust heat and water-jacket heat of gas-engines. Therefore he (Mr. Clerk) said the real efficiency of the producer was not more than some 67 per cent., instead of the 84 per cent. Then, again, he was puzzled in reading the paper to know how the author had determined the volume of gas produced by the producer. He was still more puzzled when he got to the works to find the producers—twelve in number, in three sets—were capable of converting 240 tons of coal into gas per day, and that they were actually converting 200 tons of coal into gas when he was there, that the greater part of the gas was used for heating furnaces, and that the gas-engines were only taking a small quantity of the gas by a sort of bye-pass—giving it additional scrubbing with sawdust, and then using it in the engines. Mr. Humphrey had been kind enough to inform him of the method he adopted to determine the volume of gas from the producer. He told him it depended upon the estimation of the carbon in the fuel and the estimation of the carbon lost, by collecting all the scrapings of the flues and collecting every possible waste of carbon

—making allowance for this loss of carbon, and assuming that the difference between the carbon in the fuel and the carbon lost had appeared in the gas. Under the circumstances, he (Mr. Clerk) did not say Mr. Humphrey could have done any better. What he did say was that, before one could come to any correct conclusions—such conclusions as justified one in speaking of large central stations using the gas with certain percentages of economy—one should have a moderate sized station on the Mond system (say, giving 2000-horse power), where all the gas went to the gas-engines. In many tests he (Mr. Clerk) had conducted on other gas producers, it had always been his practice to weigh out all the fuel, and to make sure that the fuel he was weighing out was burnt in the producer; and weighing it after cooling to find exactly what had gone into the gas, or, to take the other way, measure the gas through a holder. Of course, this could not be done with producers on such a huge scale as the sets at Winnington. His view was that, in this process of estimating the carbon, Mr. Humphrey had in some way failed to trace all the carbon. His reason for this opinion was the outcome of careful study of the different analyses given of the Mond gas in the author's former and present papers. He found from the analyses that certain amounts of oxygen from the nitrogen of the air were disposed of in certain ways. In the analyses in the present paper, of course the 42 per cent. of nitrogen meant that a little over 10 per cent. of oxygen—ten volumes of oxygen—was carried in with the 42 of nitrogen, and the oxygen was divided up among the carbon, the carbonic acid produced, and the carbonic oxide, and that a certain amount of hydrogen was made. He calculated what water was decomposed; and so far as he could discover from the analyses, a very large part of the volatile matter of the coal—that was, the original coal—had not disappeared. In other words, he could not trace the hydrogen from the whole of the volatile matter. Therefore, he felt that, although the author had done everything with every possible care, he had not really done everything to establish figures of this class that were truly world-wide figures, and that other experiments than those already made should be carried out. His impression was from the analyses that the unit efficiency of gasifying in the producer did not amount to much over 50 per cent.; and that the method of cooling caused considerable loss.

Mr. Humphrey: The gas has lately been measured in the small plant at Sandiacre; and the efficiency is rather higher.

Mr. Clerk: I am glad to hear that it is satisfactorily settled.

Mr. Humphrey: You are quite right about the steam. We use the exhaust steam.

Mr. Clerk said his impression was that the analyses might not be representative, and that the efficiency would be lower; but he was glad to learn it was about 67 per cent. With regard to the large power gas-engines, he had great pleasure in seeing the two engines at work at Winnington—the Crossley and Premier engines. They were both running exceedingly well—in fact, he had never seen large power engines working so well. Large power engines had given great trouble in past years; and it had been his sad fate to assist and consider the cause of breakdown in many engines of over 100-horse power. Although, however, these two engines worked very well, it must not be supposed that makers were yet in a position, either on the Continent or here, to execute great orders for such large engines. Both of those he had seen were to some extent not exactly in the experimental position, but had emerged too recently from the experimental condition for one to have absolute confidence in going ahead too fast with them. For example, in the Crossley engine, the pistons were not water-jacketed. Now in gas-engines the great difficulty was, when they came to big engines, to prevent what was called pre-ignition. That was to say, in all gas-engines they took in an inflammable mixture, which was compressed, and ignited at the proper time. But if the engine was above a certain size, the heat was conducted away from many of the parts too slowly, and those parts became practically red hot. The consequence of this was that gas-engine makers had to adjust the conditions to prevent this pre-ignition; and if they kept the temperature down sufficiently, they would not have it. Messrs. Crossley, in settling the compression of this large engine at 60 lbs., had acted very prudently, and with full knowledge of what was before them. They knew quite well that, with a water piston, if they compressed too high in a large engine of that size and speed, they would have pre-ignition. The engine had been beautifully adjusted; a little bit more, and there would have been pre-ignition. The makers knew this; and therefore they did rightly in not increasing the compression. They also did rightly, in his view, in the first large gas-engine they built, in avoiding the use of a water-jacketed piston. He, however, believed, with care, the water-jacketed piston would succeed, although there were very few at work yet. He should be delighted to see large gas-engines come in at once; but he thought the interests of gas-engines would be better served by moving a little slowly, but not too slowly. Do not, he said, in conclusion, be discouraged by what was stated about large Continental gas-engines, because the makers had precisely the same difficulties to contend with as in this country.

Mr. James Atkinson (Messrs. Crossley Bros., Limited), having had something to do with the design of the Crossley engine referred to in the paper, said he wished to make one or two remarks in reference to it. When it was started, it was the most powerful, successful engine in England. Previous attempts on large engines had been made, but had not been successful. It was designed in accordance with a very strict specification with regard to power and regularity of turning moment, and was found to comply with the requirements. Personally, he felt very proud at having had to do with it. He was obliged to Mr. Humphrey for showing so clearly the regularity of the turning moment, and that it only deviated from absolute regularity by 0·38, or (say) ¼°, when running on its intended load. The method of building up the fly-wheel was the invention of Mr. Crossley; and he believed it was the first instance in which the full strength of the fly-wheel rim was maintained while keeping a smooth external surface. Of course, fly-wheels in gas-engines had to contain a large amount of inertia; and to keep them light, it was necessary that the periphery of the wheel should run as fast as possible. As it had to be transported by rail, it had to be in parts; hence the importance of the mode of making the joints. This efficient fly-wheel, combined with the method of governing, enabled the engine to give the remarkable regularity shown in the paper. It was interesting also in this connection to notice that, on the point of the regularity of the Crossley engine, the total variation was less than that shown by the Premier engine, in spite of the better sequence of the explosions to which Mr. Humphrey referred. The sequence of the explosions was not so important as most people imagined. He was much impressed by the illustration showing the Premier engine diagram superposed on the Crossley engine diagram. The Premier engine (taking the higher calorific value of the gas so as to compare with the figures given for the Crossley engine) gave a thermal efficiency of 30·38 per cent. on the indicated horse power, and 22·87 per cent. on the brake horse power; the respective figures for the Crossley engine being 26·23 and 21·78. As Mr. Humphrey had stated that the Crossley engine had improved 1 per cent. since the trial was made, its thermal efficiency per brake horse power was practically the same as the Premier; and this, though the maximum pressure in the Crossley engine was only 250 lbs. per square inch, compared with 330 lbs. in the Premier. For business purposes, therefore, the engines gave equal power for the same expenditure of gas while the Crossley engine had the advantage of fewer and lighter working parts, lighter strains, less wear and tear, and less lubrication, as clearly shown by its better mechanical efficiency. The mechanical efficiency of the Crossley engine was given in the paper as 83 per cent.; but he had no doubt that it would be over 90 per cent. when the engine had got into free working order, as all the large engines gave over 90 per cent. mechanical efficiency. The Crossley engine could have been constructed to give a higher thermal efficiency by giving a greater compression. But being the first engine made of such a size, it was desirable to keep on the right side; and the result at any rate was a really good satisfactory engine.

Early in the meeting, the new President (Mr. W. H. Maw) said eighteen gentlemen desired to take part in the discussion; and as the evening was now far advanced, it was decided to hold a special meeting on Feb. 1 so as to finish the debate.

## THEORY OF THE WATER-GAS PROCESS.

By Drs. H. Strache and R. Jahoda, of Vienna.

**[Abstract Translation of Articles published in the "Journal fur Gasbeleuchtung" last year.]**

### III.—The Blow (*Concluded*).

It has been shown in the foregoing portions of this communication that the efficiency of a water-gas generator during the blow is independent of the velocity of the blast and of the height of the bed of fuel, but that the temperature of the contents of the generator considerably influences the efficiency, which is far higher at low than at high temperatures. This is due to the fact that at low

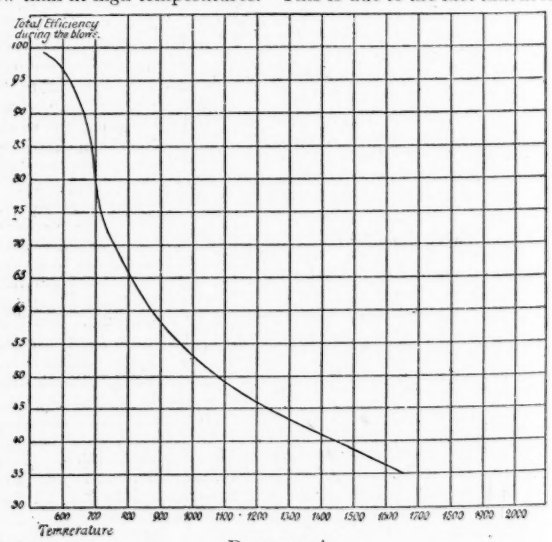



Diagram A.

temperatures, chiefly carbonic acid is formed by the combustion; while at higher temperatures more carbonic oxide is produced. The diagram marked A shows the efficiency when a cold generator

is raised by the blast to a given temperature. A series of different degrees of heat in the generator are traversed; and the total efficiency during the whole time of the blow is the sum of the efficiencies recorded for each moment. The diagram shows the mean values; the abscissæ representing the temperatures of the generator, and the ordinates the mean efficiency. It is evident that the curve drops rapidly between 650° and 900° C.; and consequently it is advantageous to maintain the temperature of the generator as low as possible, and never allow it to exceed 900° C. (= 1650° Fahr.).

It has now to be demonstrated that complete decomposition of the steam can be attained at such low temperatures as these, if the rate of flow of the steam is correspondingly reduced. Therefore there are next to be considered the conditions of

### I.—The Run or Make.

We have to establish the relations which subsist between the temperature in the generator and the velocity of the steam on the one hand, and the quantity of undecomposed steam in the gas, the carbonic acid formed, and the heat carried off by the gas and steam and radiated from the generator on the other hand. It was thought likely that the heat would be better utilized the smaller the quantity of undecomposed steam which passed through the generator, because, owing to the high specific heat of steam at the temperatures employed, much heat would be carried away from the generator by the discharged steam. Further, it was probable that a high rate of flow of the steam would be attended by the discharge of much undecomposed steam with the gas; while the quantity of gas produced in a given time would be very small if the rate of flow of the steam was too low. Again, the heat radiated from the generator would be independent of the make of gas, and consequently relatively high when the rate of flow of the steam was low. Too low a rate of flow of steam appearing, therefore, to be unfavourable on account of the relatively high loss of heat by radiation, and too high a rate also unfavourable on account of the passage of undecomposed steam through the generator, an attempt was made to ascertain from the efficiency found, the most favourable rate of flow of the steam for each temperature. Finally, from the results of the investigations of both the blow and the run, the collective or total efficiency was found for each temperature and each rate of flow of the steam. The investigation of the run was made in the following manner.

After the generator had been made hot by the blow, a Le Chatelier pyrometer was introduced into its hottest point, which was located in a manner described later; and as soon as it gave constant readings, the steam was turned on, and samples of the gas made were taken at definite periods. At the same time, the temperature of the effluent gas was observed by means of a Le Chatelier pyrometer. The temperature of the generator could be taken only in the lower part; and it was thought desirable to deduce therefrom the mean temperature in the vessel, for the sake of comparison with the mean temperatures observed in the investigation of the blow. A series of experiments, in which the temperature in the lower part was measured, while the mean temperature was calculated from the heat stored up in the vessel, as described earlier in this communication, rendered the deduction possible. The radiation from the generator was determined only once. The temperature of the generator-shell was observed at different heights, and multiplied by the coefficient for the radiation, which was 10 calories per square metre. It was taken as constant in all the investigations, though doubtless it would actually be slightly less when the temperature in the vessel was unusually low. Only a relatively small error, however, would thus be introduced. The samples of gas were taken, and the undecomposed steam and the carbonic acid determined in the following way.

Water gas, as it issued from the generator, was passed through a small filter into U-tubes of which the capacity had been exactly determined. The tubes were provided with well-fitting glass cocks, and were wholly immersed in boiling water. The cocks were closed in order at given times. When the closed tubes were cooled to the temperature of the room, a great vacuum ensued within them, owing partly to the cooling of the contained gas, and partly to the condensation of steam. The volume of gas contained in them was measured at the ordinary temperature; and therefrom the corresponding volume at 100° C. (*i.e.*, the temperature of boiling water) was calculated. On deducting this volume from the capacity of the tube, the difference represented the volume of steam present. The percentage of carbonic acid in the gas collected was then determined. The water gas formed during the run was washed with water in a scrubber, and received in a small holder provided with a scale on which the contents could be read off to within 3½ cubic feet, and having a device for automatically recording the position of the holder at each minute during the run. The volumes read off were corrected to 0° C. and 760 mm., and indicated the rate of flow of the gas made from the generator. Naturally this rate diminished as the run proceeded, because the extent to which decomposition of the steam, which was introduced at a constant velocity, took place decreased in the course of the run. From the amount of undecomposed steam in the gas and the rate of flow of the gas made, the rate of flow of the steam could be calculated. The values obtained for these velocities are relative, and not absolute.

Diagrams B and C show the percentage of carbonic acid in the gas, and the steam passing through undecomposed (in volumes per cent. of the effluent mixture of gas and steam), for different rates of flow of the steam with different temperatures in the generator. The temperatures are expressed in degrees Centigrade, and the rates of flow of the steam in metres per second. From these diagrams it is clear: (1) That at a particular temperature both the steam passing through undecomposed and the proportion of carbonic acid in the gas largely increase with increase in the rate of flow of the steam, and, moreover, increase to a similar extent. (2) That with a constant rate of flow of the steam both the steam and the carbonic acid in the crude gas decrease

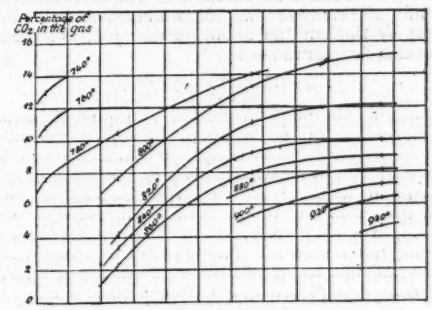



Diagram B.

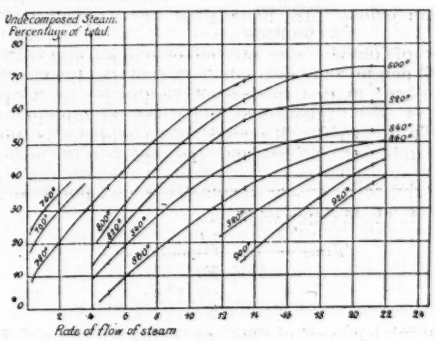



Diagram C.

with increase in the temperature. (3) That at low temperatures the carbonic acid and steam in the crude gas can be reduced to a minimum by diminishing the rate of flow of the steam.

The efficiency for the run is calculated from the loss of heat from the generator and the calorific value of the water gas made. The loss of heat comprises the heat of formation of the water gas, the sensible heat of the water gas made and of the steam passing through undecomposed, and the heat radiated from the generator. These values were calculated; and their efficiencies were then arranged according to the mean temperatures of the generator, for different velocities of the steam, as given in Diagram D. Thence

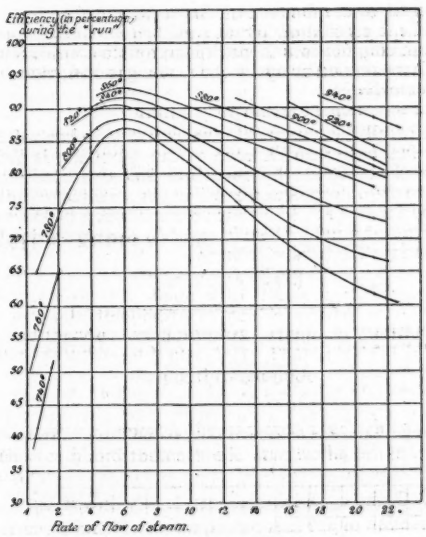



Diagram D.

it is clear that, for any given temperature of the generator, there is a particular rate of flow of the steam which affords the highest efficiency. The maximum efficiency in the different trials ranged from 87 to 93 per cent. For determining these curves, only results obtained by the direct measurement of the temperature of the generator could be applied; and of these there were only four series, comprising 24 determinations. Consequently the position of the maximum could not be determined exactly for every curve with respect to the velocity of the steam. The maximum

efficiency appears from the diagram to be in all cases at the rate of flow 6. But it is possible that more exact examination would throw it somewhat to the left of that line for some curves, and that the most favourable rate of flow would be somewhat lower.

It has already been explained how the loss of heat during the runs was determined. This loss of heat must, of course, be replaced in the blows. If the amount of heat lost is represented by X, then the carbon consumed in restoring this heat is found by dividing X by the heat of combustion of carbon, multiplied by the efficiency obtainable in the blow at the temperature in question. If this efficiency for the given temperature is denoted (in percentage) by N, then the carbon consumed (= $k$) in restoring the lost heat is as follows:—

$$k = \frac{X}{8080 \times N} \times 100.$$

In order to ascertain the collective or total efficiency in blow and run for any particular mean temperature, the total amount of carbon consumed in both blow and run must first be found. The carbon consumed in the run must be added to the consumption of carbon found as above. Let it be denoted by C′, and the heat of combustion of the water gas produced by V′. All quantities are regarded as referring to 1 cubic metre of water gas. The total efficiency (=T) is found by dividing the heat of combustion of the water gas made by the sum of the heats of combustion of the carbon consumed in the blows and runs. Thus—

$$T = \frac{V'}{C' \times 8080 + \frac{X \times 100}{N \times 8080} \times 8080} = \frac{V'}{C' \times 8080 + \frac{X}{N} \times 100}$$

The loss of heat from, or cooling of, the generator during the runs (= X) comprises, as already indicated, the heat of formation (= B), the heat carried away (= E) by the gas and steam, both referred to 1 cubic metre of gas made, and the heat radiated. If the latter is denoted by S per unit of time, and the quantity of gas made in the same time (or the rate of flow of the gas) by G, then the heat radiated per cubic metre of gas made will be $\frac{S}{G}$. Hence the total efficiency will be—

$$T = \frac{V'}{C' + \frac{B + E + \frac{S}{G}}{N} \times 100.}$$

Now, in this expression, the three factors V′, C′ and B (representing respectively the heat of combustion of and the carbon in 1 cubic metre of water gas, and its heat of formation) cannot change very considerably. Hence it appears the total efficiency is chiefly dependent on the heat (= E) carried away by the gas and steam, and the efficiency in the blows (= N). The radiation $\left(\frac{S}{G}\right)$ comes into account only when the quantity of gas made in unit time (= G) is very small, and consequently makes the value $\frac{S}{G}$ large.

These calculations make it possible to give a heat-balance for each thermic condition of the generator, and for each rate of flow of the steam. It is made up as follows:—

1.—The heat of combustion of the water gas (= V′).
2.—The heat carried off by the exit gases during the blows, including the loss through incomplete combustion.
3.—The heat carried away by the water gas and undecomposed steam (= E).
4.—The heat radiated from the generator.

The sum of all these quantities represents the heat of combustion of the fuel used; and if each of the quantities is divided by their sum and multiplied by 100, then the separate items in the heat-balance are obtained expressed in percentages of the calorific value of the fuel used. The heat of combustion of the water gas thus expressed as a percentage is equal to the expression (T) used earlier to denote the total efficiency.

*(To be continued.)*

## MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

A Meeting of the above-named Association was held last Saturday. In the afternoon, the members paid a visit to the Atlas Meter-Works of Messrs. George Orme and Co. (Meters Limited), at Oldham, which had been kindly thrown open to them. At the conclusion of the inspection, a vote of thanks was accorded to the firm for their courtesy in allowing the party to go through their establishment.

In the evening, the members assembled at the Manchester Technical School, under the presidency of Mr. C. Berry, to hear a paper by Mr. W. Baxendale (Chorley) on—

In bringing before you a paper on carburetted water gas, it is not my intention to involve you in a series of chemical reactions, relating to the poisonous nature of the gas, as this is a subject which has been dealt with, and is being dealt with daily, by some of our most eminent gas engineers and gentlemen of the medical profession. So, after making a brief reference to the every-day uses of it, I shall leave it for these gentlemen.

We are all aware, as members of the gas industry, that asphyxiation is brought on by the inhalation of gas; and, in my opinion, it does not matter whether it is coal gas, cannel gas, or carburetted water gas. The only difference is that coal gas is weaker in carbonic oxide than carburetted water gas; so that what coal gas will do in that respect, water gas will do also, but in a shorter time, owing to its being stronger in carbonic oxide. This poisoning, as it is termed, only takes place when the gas escapes unconsumed; if it is burned, it is no more injurious than any other gas. So far as escapes are concerned, it could be as easily identified and dealt with, and exactly in the same manner, as coal gas. As a rule, the people who do the most talking in public about the poisonous nature of this gas, are just the people who know the least about it. As they say in Lancashire, they are "talking off the top."

The gas that is manufactured on a gas-works, is not supposed to be inhaled. If that had been intended, no doubt we should have it perfumed with *eau-de-cologne* or essence of musk, instead of that never-to-be-forgotten smell of sulphuretted hydrogen, which always seems to make its presence known in "Mighty Atoms," whenever it can escape the action of the purifiers. This smell of gas is not so pleasant as to make one think that people with any common-sense at all would sit in a room where they knew gas was escaping. Of course, in the case of a broken main, it is entirely different. But there are exceptions to every rule. As when the Irishman on seeing for the first time a gas-jet in his bedroom had no idea about turning the tap to put out the light, but simply blew it out and retired to rest. Of course, in the morning, the consequence was that he was a miniature gasholder.

While speaking of gas-jets, just a word on the most suitable kind of burners for carburetted water gas. If the full value of this gas is to be obtained, it must be by the use of burners with large apertures. The flame of the gas is more stable, and does not require so much oxygen for its consumption; and if burners with small apertures are employed, the loss of illuminating power is much greater in proportion than with coal gas. This will account, to a certain extent, for the trouble which is often experienced where gas of 20 or 22 candle power has been supplied to be consumed through burners with very small apertures, suitable for gas made of that power by the aid of cannel.

### The Process.

For the benefit of members who have not had the pleasure of seeing one of these plants, I will give a brief description of it. The three principal parts are the generator, the carburettor, and the superheater. The first vessel or generator is lined with a special kind of fire-brick, to withstand very high temperatures, and contains the coke-fuel bed, usually 5 to 6 feet deep. It is provided with a charging-door for the renewal of fuel, clinkering-doors, and ash-hoppers.

The second vessel, or carburettor, is also lined with fire-brick, and has its interior stacked with small rectangular fire-blocks, placed in the form of chequer-work, and so as to allow a space of about 2 inches between each, through which the gases pass in close contact with the heated surfaces. The carburetting oil is admitted at the top of this vessel in the form of a fine spray, and becomes vaporized in contact with the heated chequer-work of bricks.

The third vessel, or superheater, is lined and stacked in a similar way to the carburettor, and has at its upper extremity a stack-valve, by means of which communication can be made with the chimney.

Each of these three vessels has an air-inlet with a regulating-valve, and is supplied from a general air-blast main, in which pressure is maintained by means of a high-speed fan. Sight-glasses are fixed at various points, to allow the operator to observe the interior condition of the hot vessels as occasion requires; and a set of pressure-gauges indicates the gas, air, steam, and oil pressures, at all times.

In the operation of gas making, the primary air is admitted at the bottom of the generator for a period of three or four minutes during which time the fuel is raised to a high state of incandescence, and large volumes of producer gas are formed. This gas consists chiefly of nitrogen and carbon monoxide. The nitrogen is derived from the primary air, the oxygen of which combines with the carbon of the fuel in such a manner that 25 to 30 per cent. of the ultimate product is almost wholly carbon monoxide, giving the following equation:—

$$O_2 + C = CO_2 \text{ and } CO_2 + C = 2\,CO.$$

This producer gas passes into succeeding vessels, where, by the admission of secondary air, it is burnt; the heat being absorbed by the fire-brick chequer-work, which has to be maintained at a bright cherry red. The stack-valve on the superheater being opened, the products of combustion pass into the chimney.

At the end of this operation (which is termed the "blow"), the coke-fuel in the generator should have attained a temperature of about 2000° Fahr., and therefore be in a condition for making water gas. The air-valves are accordingly closed, and steam, at a pressure of 100 lbs. per square inch, is admitted below the heated fuel; the stack-valve is closed; oil is sprayed into the carburettor; and the resulting carburetted water gas passes through the head of the superheater into the washer or scrubber, then to the condenser, and then to the relief holder. This gas-making period is termed the "run," and lasts six or seven minutes, at the end of which time the temperature of the fuel in the generator will be depressed several hundred degrees. The run is then taken off

and succeeded by the blow as before; and this is what goes on alternately, until about every 8 or 12 hours, any accumulation of clinkers is removed from the bottom of the generator-fire.

The action of the steam on the carbon of the incandescent fuel gives the following equation: $C + H_2O = CO + H_2$. The product of the action consists, therefore, of equal volumes of carbon monoxide and hydrogen; and this mixture constitutes the water gas in the carburettor, as already described. It is always as well, in order to thoroughly utilize the oil, to shut it off before the expiration of the time of running or making gas, so that for the last few minutes of each run only pure water gas is made, which absorbs, on its passage through the carburettor, the last traces of oil that may be left therein. The generator is charged with coke about once every hour—an operation which only occupies about half a minute. The clinkering of the generator grate, which really is the only laborious work connected with the process, is generally done by the man attending the boilers, and not by the man operating the plant.

As carbonic acid is an incombustible gas which reduces the temperature and luminosity of the flames of other gases when mixed with them, it is most desirable to restrict the formation of this impurity; and, although it cannot be wholly avoided, the proportion made should not exceed 3 or 4 per cent. This may afterwards be removed by passing the gas through lime, or its depreciative effect may be compensated for by the use of a little additional carburetting material.

The temperature necessary in the carburettor and superheater for volatilizing and fixing the oil, is much less than the heat required in the generator; and variations are sometimes desirable to suit the particular descriptions of oil. But such adjustments may be made with ease and precision by suitably regulating the supply of secondary air. Too great a heat produces lamp-black; and too low a heat, an undue proportion of tar. The chief objects of the operator should therefore be to avoid both extremes, and produce neither lamp-black nor an excess of tar.

Then as to the working or operating of the plant, this is entirely a different system to that required in the manufacture of coal gas. It has been very appropriately termed the "kid-glove process." And so it is; for the operator has no need whatever to so much as soil his hands. All he has to do is a matter of opening and shutting valves, which is done by a series of levers, &c. It would be useless for a man who was not in a good physical condition to attempt to charge a few rounds of coal-gas retorts on the hand-charging system; but with the carburetted water-gas plant, no muscular strength is required, as any active man of ordinary physique, with careful and steady attention to his duty, could easily make himself efficient in about three or four weeks. This I can vouch for, as on our works at Chorley we have two men who can start the plant and run it with perfect ease, after having had a month's experience.

As we have not the accommodation on our works for making elaborate tests, I will just give you one of the everyday results we obtain from our plant. Per run of 10 gallons of oil, we get 0.1 an average 3000 cubic feet of 23-candle power gas, equalling about $3\frac{1}{3}$ gallons per 1000 cubic feet of gas made. The average weight of fuel (coke) required for the generator per 1000 cubic feet of gas made was 31 lbs., and 9 lbs. of breeze for the boiler.

### Its Advantages.

As to the advantages of this plant, they are numerous. In the first place, the economy of space required for the producing plant is generally estimated at about one-fifth of what would be needed for retort-houses. Then, again, the cost of water-gas plant is undoubtedly cheaper than building a retort-house to produce the same amount of gas—thus reducing to a great extent the outlay on capital.

During the last six months, there has been erected on the works with which I am connected (Chorley) a carburetted water-gas plant to make 300,000 cubic feet per day, which quantity it could easily have exceeded if it had been able to run for 24 hours. But up to the present time it has only been worked two shifts per day of 8 hours each. Along with engines, pumps, blowers, tar settling tank, gasholder, boiler, and hydraulic lift, the whole has been erected and put into working order by Messrs. Humphreys and Glasgow, of London, for a sum not exceeding £5000.

It must also be remembered that, by this process, there is no production of coke; and not only is the ground required for dealing with this residual dispensed with, but a home market is formed for a portion of the coke produced by the coal-gas apparatus, and thus the quantity for sale in the open market is reduced, and the necessity is avoided for lowering prices so as to get clear of stocks.

Another great advantage while dealing with coke is this: Supposing you are overstocked with coke, instead of reducing your prices so as to clear it off, you can knock off some of your coal-gas retorts and put your carburetted water-gas plant full on, which would greatly relieve your coke stocks; and the manager of the works, having the two systems under his care, would be able to use his own judgment as to their respective uses. He will no doubt be guided by seasons, stocks, prices, &c. Should the coke business be brisk, the working of the carburetted water-gas plant could be reduced; and on the accumulation of stock, he could put on his water-gas plant and reduce the number of coal-gas retorts.

Then there is the readiness with which the water-gas plant can be put in action. In our case at Chorley, where the plant is only worked two shifts of 8 hours each day, it is left (say) at 10 o'clock at night; and next morning, after the man has been on the works fifteen minutes, he can be making gas at full. And as to the regulating of the quality of the gas, this system, I think I can say, is perfect.

It is a well-known fact among managers that the coal they receive varies at times in quality, and the heats go down slightly, or the exhauster man has a quiet sleep and gets a little too much pull on; the consequence being a reduction in the illuminating power. But by the carburetted water-gas system, there is no variation in the quality of oil, as this is the same from day to day; and the oil for each run is easily measured by means of a special meter, and can be increased or diminished in a few minutes.

The contrast with which you can change from (say) 17 or 18 to 30 candle power is very noticeable when compared with the time it would take to make this alteration in the coal-gas system, by substituting cannel for coal. On the water-gas system, all that is required is to put in so many more gallons of oil to the run, and then the change is complete. After visiting a water-gas plant (where you see no such thing as steam and clouds of smoke and coal-dust blowing about), and then passing into a coal-gas retort-house, you can hardly help noticing the very marked difference in the comforts of the operators in each case; and there is no need for wondering how it is that men in the coal-gas retort-house all want to be transferred to the carburetted water-gas plant.

To the manager who has charge of a works, it is a great relief to him to know that this system is one of gas making alone, as there are no residuals attending the process, with the exception of tar, to the amount of from 10 to 15 per cent. of the oil used. Residuals to a manager are a source of great trouble, and cause more anxiety and worry than all the rest of his duties put together; so that I think if you have a plant which makes no residuals (except tar), it must have a tendency to lessen to a great extent the everlasting worries the manager is subject to.

The saving in labour by this process is another very marked advantage; but as I have not had time to work out a comparative statement of the two systems, I shall leave this for some future occasion.

### Disadvantages.

Then, lastly, we come to the disadvantages of carburetted water gas. But, so far as the experience I have gained from this system goes, I am not able to give any disadvantages, excepting the price of oils. This at the present time is certainly a very sore point, when we refer to a paper that was read before the Incorporated Gas Institute some years ago by Mr. Stelfox, the Corporation Gas Engineer of Belfast. He gave a few tests he had made on the water-gas system, using both Russian "Solar" distillate and American distillate. He gave oil then at about 2d. or $2\frac{1}{4}$d. per gallon. With oils at this price, I think I can safely say that the future of carburetted water gas would undoubtedly be a most prominent and prosperous one. But then to look on the other side, with the present prices of these oils—which are, I believe, from $4\frac{1}{2}$d. to 5d. per gallon—there is not the slightest doubt that this will cast a very serious gloom over the future career of carburetted water-gas plant.

In the course of a short discussion on the paper,

Mr. Broughton remarked that the calorific power of water gas was considerably less than that of coal gas; and he said he had heard that at some places there had been complaints on this account from works using gas for motive power.

Mr. Haynes said the variation in the character of the oil brought by different ships would affect the question of the manufacture of water gas. He should like to know if the author had any means of testing the quality of the oil.

Mr. Hill wanted information as to the candle power of the gas.

Mr. Garlick said he almost questioned whether it was worth while to improve the illuminating power of gas nowadays, as, in his own experience, they had more complaints when the quality was exceptionally good than when it was inferior. He could not account for the fact, but it was so. The water-gas system had, however, its advantages, and would probably come more to the front as improvements were introduced in connection with it.

Other questions having been put by several members,

The Chairman said the author had given the present price of oil as one of the disadvantages of the water-gas system. Did he not think that if water gas became more general, the price of oil would still go up, owing to the greater demand?

Mr. West remarked that he did not believe it would pay to use water gas at towns very far from the sea. In places like Belfast, Plymouth, and Scarborough, they were, he believed, doing pretty well; but in the Midlands they could not show much saving. As to oils, his experience was that there was great variety in them. It had been found, when water gas was used in connection with gas-engines, that the air supply had to be altered to consume the gas properly.

Mr. Baxendale replied to the questions put to him on the paper, and the proceedings closed with the usual vote of thanks.

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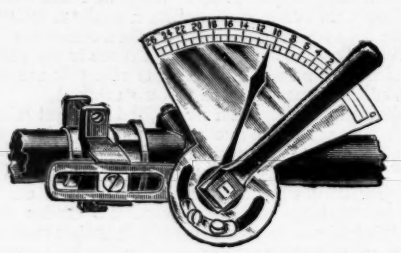
A coal conveyor which is claimed to be the largest in the world has been erected at Cape Breton. It is reported to be equal to dealing with 750 tons per hour, and carries coal 1000 feet into vessels alongside.

A new petroleum field has been discovered at Beaumont, Texas. It is reported that the output of the single well now spouting amounts to more than 25,000 barrels daily; and a large quantity has run to waste.

## A GAS-TAP INDICATOR.

It is a somewhat trite saying that, so great is the want of knowledge shown by the average consumer about gas management and control, there is hardly any article consumed with such carelessness as gas. A Governmental Committee reported some time ago that "consumers got far less light for the amount of gas consumed than they were entitled to—in some instances only one-fifth." Think what this means, five shillings' worth of light for a pound's worth of gas—a loss of half-a-million of money per annum to small consumers in London alone. Much of this loss is due to pressure alone; and the only effective remedy for the evils attendant on excessive pressure is a proper and systematic control of the supply at the main cock. No small tap near the burner can control strong pressure, and at the same time give the maximum of light for the amount of gas passing through. In fact, one of the elements essential to the construction of all gas-burners is to avoid excessive pressure at the point of issue. As has been well said: "It is most essential in the combustion of gas in lighting or cooking to employ means to counteract the pressure by the use of some effective regulator; and whenever a proper instrument of this kind is employed, it must be attended with considerable economy, as the pressure is reduced to the degree most essential for obtaining the amount of light from the gas." Many large consumers do use such governors or regulators; but with small consumers the expense of these (say, £2 and upwards) is out of all question.



The simple apparatus shown herewith is not a governor or regulator in the technical sense. It is called an "Indicator," because it indicates the number of lights the consumer may expect for the amount of gas passing through the main cock. It consists of an ndex, simply attached to the cock near the meter by five screws only, without interfering in any way with the gas company's property; and it enables consumers (householders or shopkeepers) to adjust their gas pressure according to their requirements by the handle of the main cock.

It is, of course, to the interest of gas companies to encourage the use of such simple contrivances, which would benefit the public and restore confidence to the consumer; for as the patentees (Messrs. Reece and Gaskin) remark: The consumer, receiving a better light for the money he pays, and believing in the truth of his gas-meter, would relieve the company from the expense of changing meters, and the company would gain fresh customers. In the incandescent burner, combined with effective control by some such means as this indicator, gas companies possess the most powerful weapon to fight the electric light.

The manufacturers of the little appliance in question are the "Saving" Gas Indicator Company, of Burdett Road, E., whose wholesale agents are Messrs. Biggs, Wall, and Co.

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**The "Circular of Inquiry Nuisance" Again.**—A particularly objectionable form of inquiry circular has recently been issued by the Barry (Glamorganshire) Urban District Council. It has been addressed to Gas Managers, Town Clerks, &c., throughout the country; and more than one angry letter of remonstrance has been addressed to the "JOURNAL" protesting against the style of questions put. The circular is accompanied by a printed letter, stating that the Gas and Water Committee are considering the salaries of the chief officials and certain other officers in the employ of the department, and they desire to obtain (for the use and guidance of the members of the Council) particulars as to the remuneration paid in other towns to officials holding similar positions. The questions to be answered are the following: "1. Have you a Consulting Engineer? If so, is he responsible for the design and the carrying out of all new works, and how is he paid? 2. Have you a Resident Engineer or Manager? If so, what is his salary? Is he allowed to take pupils, and who receives the premiums? 3. Have you an Assistant Engineer or Manager? If so, how much does he receive? 4. Have you a Secretary or Accountant; and what is his salary? Is he responsible for the keeping and preparation of all accounts and for the collection and payment of all moneys? 5. Have you an Assistant Secretary or Accountant? If so, what is he paid? 6. How much do you pay the following officials? (*a*) Chief Clerk, (*b*) Rental Clerks, (*c*) Slot-Meter Collectors, (*d*) Store Keeper, (*e*) Time Keeper, (*f*) Works Foreman. 7. Would you object to your replies being tabulated and printed, and a copy sent to each of the gentlemen who is kind enough to furnish the information asked for?" As one of those who sends a copy of what he truly styles this "unique production," remarks: "The idea of gentlemen desiring to have their remunerations printed and circulated, is something I have never heard of before."

## FUTURE OF THE LONDON WATER SUPPLY.

The valuable paper on the above subject which was read by Mr. R. E. Middleton, M.Inst.C.E., at the meeting of the Surveyors' Institution on the 10th ult., and published in the "JOURNAL" a fortnight later, is producing some equally valuable opinions. The discussion was opened by Mr. W. Whitaker immediately after the reading of the paper; it was then adjourned to the meeting on Monday of last week, and will, owing to the number of engineers who desire to make a contribution, be resumed next Monday. In the meantime, we give a report of the salient features of the debate so far as it has proceeded.

Mr. W. WHITAKER (Croydon) considered London fortunate so far in having been able to get its supply from a comparatively short distance. But such a supply as was afforded by the Thames depended for safety on being "adequately guarded;" and the difficulty was that the guarding of it was in human, and not infallible, hands. Opponents of the Thames, of course, claimed that they advocated the drawing of the supply from some source which did not want so much guarding. As to the chalk area of Kent, he thought Kent was able to supply itself, even allowing for increase of population, and could possibly afford to spare something for its neighbours. An allusion to the difficulties of Essex in regard to water supply brought the speaker to the question of waste, which he regarded as of the utmost importance in considering the adequacy of a water supply. There was a great deal of preventible waste in London; and he considered the existing allowance of 35 gallons per head in London was excessive, and included a great many gallons that were absolutely wasted. If the authorities had no means of stopping this, they ought to seek enlarged powers; indeed, the repression of waste formed a strong argument for giving the control of water to a public body. It should be remembered that the Thames had to answer purposes other than water supply; while the Welsh rivers were comparatively little used. He thought very few people advocated the entire abandonment of the Thames and Lea; the arguments were rather against an extended than a continued use. To altogether give up the present sources would be rather outside the range of practical politics. He thought it was about time another Royal Commission was due, as it was unusual for a long time to intervene between them. But he had never learnt that anybody was much the better for these Commissions. Reverting to the subject of water derived from chalk areas, he said the ultimate destination of the water that went into the chalk was a curious question; the quantity of water got out being sometimes a mere fraction of that which went in. Surrey had no water to spare for a supply outside the county; and he thought that for an extension of the London supply, it would be necessary to look to areas outside the Thames Basin.

Mr. J. SHAW (Boston) sent a communication, in which he remarked upon the great scope of the paper, and the difficulty of criticizing the immense amount of information conveyed in it. The population and supply per head had, he said, increased by leaps and bounds during the past quarter of a century; and it was difficult for the water engineers to push back the rate of consumption to what it was then. With 30 gallons per head, at least 10 per cent. was "preventible waste." But the water consumers had made up their minds that a wasteful and extravagant use of water should prevail; and the water engineer must apparently provide that supply. The quality of London water had greatly improved—the "raw material" had benefited by the better sanitary arrangements of towns above the Companies' intakes, and the supervision of the inspectors appointed by the Thames and Lea Conservancies; and, with the improvements in the filtering and subsiding arrangements, the result was a very high-class water supplied to London. The Thames he regarded as the "sheet anchor" of the London water supply for generations to come; and the Lea he also regarded as good for the quantity put down to it by the Commission. But as to the supply of 47 million gallons per day from wells in the chalk in the Lea Valley, there was room for modest doubt whether this quantity could be obtained without endangering existing interests. He compared the "underground reservoir" and "underground river" theories, saying that possibly there was some truth in both. He also compared the flow of the Lea in the autumn of 1874 and in that of 1898. In the former, with less than 5 million gallons per day pumped from the wells as a maximum, the minimum natural flow of the stream was 35½ million gallons per day. In 1898, with a maximum of 40 million gallons taken from the same district, the minimum natural flow of the stream was only 23 millions. What it would have been had 25 per cent. more water been taken from underground sources all the year round, might be inferred.

Professor HENRY ROBINSON (London) said no one wished more heartily than himself a successful completion of the Staines scheme; but he had for some years been of opinion that the right way to deal with the future water supply of London was by the construction of impounding reservoirs in natural valleys of tributaries of the Thames. The scheme Mr. Hunter and the author were responsible for was based upon the taking of 300 million gallons a day from the Thames, and leaving 200 millions minimum flow over Teddington Weir; and the artificial storage required to carry this into effect had been agreed by two Commissions to be 17,500 million gallons. The reservoirs at Staines

or storing 3300 million gallons, would cost about £1,250,000 which worked out to £357 per million gallons of water stored. In Lord Llandaff's report, it stated that the cost of making up the 300 million gallons a day would be from £9,000,000 to £10,000,000. According to the paper, in 1931, 415 million gallons would be required for the supply, involving a storage of 45,000 million gallons. Studying these figures would show their bearing on what he was going to say. Many years ago, he investigated this question of the water supply of London for the Water Companies; and he then estimated that storage reservoirs could be constructed in the natural valleys of the tributaries of the Thames at the following cost: Storage requisite for 15,000 million gallons at £850,000 and for 55,000 million gallons at £1,640,000. By the construction of reservoirs of this capacity, the flow in the Thames could be maintained at 600 million gallons per day; and for £2,400,000 reservoirs could be constructed which would give a flow of 700 million gallons per day. He gave these figures with a full sense of responsibility; and they could be proved at the right time and in the right place. He recalled the laying of his proposals before Lord Balfour's Commission, and also the fact that the geological mapping of the Thames Valley was not then considered favourable to the construction of such impounding reservoirs. He impeached the accuracy of the geological survey, and referred to his own investigations, which proved (by actual borings) there were beds of solid clay underlying the whole of the valleys he had in mind. Another objection to his scheme raised by the Commission was that he proposed to impound flood water, which was then regarded as highly objectionable. But he was prepared to prove that the water flowing off the gathering-ground in these valleys would be much more free from possible contamination than would be the water passing into the Thames in the ordinary way; and, in fact, views had entirely changed respecting flood waters. His opinion was precisely what it was ten years ago; and, aided by his subsequent experience, he was convinced the solution of the London Water Question would be found in storing waters in natural valleys.

Mr. H. H. Statham (London) commented on what he considered the totally inadequate idea of water engineers as to the amount of water per head required for a city like London. The fact that, at this time of day, a necessary like water was served out by private companies (whose interests were those of the shareholders, and not those of the public) was a monstrous anomaly, so monstrous that he wondered the public opinion of London had not risen against it long ago. The tenor of his remarks which followed was that the quantity of water per head allowed was totally insufficient; and this opinion appeared to be based on the fact that he had measured the water which he required in his bath in order to secure total immersion, and had found it amounted to from 60 to 70 gallons. If statistics were secured of the water used in average upper class houses in England, he was convinced it would be found that the consumption per head would be more than 30 gallons; and he did not think that less than 50 gallons per head ought to be calculated upon. As education progressed, and the more people learnt about health, the more they would understand that the copious use of water was desirable. Speaking of waste, he condemned the system of house-to-house visitation as at present performed, on the ground that it caused irritation. The minor officials who carried out these investigations were always in a hurry, and wanted to show that they were energetic. And the simplest way to do so was by condemning everything as wrong. He spoke from personal experience. When the constant service was introduced, he had a list sent him of half-a-dozen things that had to be renewed; and on making representations to the Company, they had to acknowledge that four of the items in his case were totally uncalled for. Supply by meter, to his mind, was the remedy for waste; and everybody would then pay for what he used. To meet the objection that poor people would use far less water, houses of low rental might be put on rate.

Mr. R. Hassard (London), as the originator of the scheme for bringing water from Wales to London, spoke at some length. As to what the author had said regarding the quantity of water to be provided in fifty years' time, that would depend upon the population; and the population at that date had been variously estimated at from 15 to 30 millions. In his opinion, these figures were perfectly illusory, and that the population in 1951 could not possibly amount to more than 12 millions, if indeed it came to that. This number of people, at 35 gallons per head per day, would require 420 million gallons daily; and the Welsh scheme would be fully capable of meeting that. Respecting the quality, water as now supplied of 17° to 18° of hardness was not water that should be served to the Metropolis of Great Britain. The Welsh water he proposed to supply had about 2° of hardness; but he did not advocate the use of such soft water as that. He suggested the incorporation with the soft Welsh water of about 30 million gallons daily of most beautiful water which was to be found in the oolitic districts of the Cotswold Hills. That 30 million gallons could be brought by gravitation to storage in London. The County Council Engineer took the scheme, but eliminated from the project the 30 million gallons of oolite water—proposing to supply the same quantity of the same quality water from a large area in the West of England. As to the cost, the Welsh scheme was estimated by the County Council Engineer at £38,800,000; and the estimates, which were verified by Sir Benjamin Baker and Mr. Deacon, agreed very nearly with his (the speaker's) own. If the population of London amounted to 12 millions in 1951, the cost would represent a capital of £3 4s. 6d. per individual of the population. This was not a heavy charge; and it was about what had been incurred for Liverpool, Birmingham, and Manchester of late years. Delivered in London, the cost would have worked out to about £91,000 to £92,000 per million gallons daily; and the Birmingham, Manchester, and Liverpool supplies varied between £90,000 and £100,000. He further estimated that, if the £38,800,000 were borrowed at 3 per cent., and paid off in fifty years, at the end of that period, the whole of the capital would cease, and the water would have been delivered to the consumer in London at 2¾d. per 1000 gallons. If the money had been borrowed at 2½ per cent. the water would have been delivered at something like 2¼d. per 1000 gallons. So that the idea which had been spread abroad that the Welsh scheme would have involved ruinous taxation was quite unfounded.

Professor L. F. Vernon Harcourt remarked that, whatever demerits there might be in the Welsh scheme, he did not think anybody could say that the water from Wales would not be preferable in many respects to the water of the Thames. There might be disadvantages; but nevertheless the water would be purer. As to Professor Robinson's remarks, he (the speaker) had occasion many years ago to survey most of the tributaries of the Thames—in fact, all the tributaries of the Thames above Oxford; and there were very few of these tributaries, irrespective of geological considerations, that would have been satisfactory for impounding reservoirs, on account of the small fall of the tributaries. There was one exception, which in the upper part of its basin, had a considerable fall. But what its geological merits might be, he did not know. There were, however, a great number of mills in existence there; and they would have something to say regarding the construction of impounding reservoirs in the district. He agreed with the author regarding the question of waste. What was called preventive—such as allowing taps to run continuously without looking after them—was waste that ought to be stopped. He imagined that, taking London as a whole, 35 gallons per head per day was a fair provision. The question of population was a difficult one. The last gentleman who spoke referred to the population being less than the author suggested; and the author himself said the question of population was a mere assumption. But one must base the question of population on something. Though possibly—probably, he might say—the birth rate was not increasing, nevertheless the influx into London seemed to be accumulating; and it would be difficult to say what might be the population of London in 1961. The author seemed to think that, if they had enough water up to 1961, they might leave London to look after itself then. But he (the speaker) thought they must really look forward to the time when London would have grown so greatly, and when the water would not be so pure as at present, that it would want to go to some other place; and there might not be a place for it to go to.

Mr. Claude Baggallay, Q.C., thought there had been a little digression from the main point of the paper. The question was whether, so long as the Thames and the Lea could be proved to be sufficient in quality and adequate in quantity, it was desirable to go elsewhere, possibly at a much greater expense, to get water for the supply of the Metropolis. He pointed out several of the irrelevant questions which had been introduced, and then he asked, Was it, or was it not, right that London should use the two rivers which Nature had discharged into or through her before she went elsewhere for water? Two things controlled this question—one was the cost of utilizing what was at their doors, and the other was the sufficiency and quality of what was there. He was not going to discuss the question of sufficiency and quality. Lord Balfour's Commission went into that; and they found that, with the maximum increase of population which could be anticipated, the flow in the rivers, with the waters in the valleys, was sufficient, if properly stored and filtered, to deal with the population for many years to come, and for a longer period than it was necessary to look forward to at present. Then as to the question of cost, that was gone into most fully by Lord Llandaff's Commission; and, from their report, it was absolutely certain that it must be more costly to go elsewhere until the sources at hand in the Thames and Lea Valleys had been used up. It was not necessary to discuss the matter. Parliament had already decided the Lea was to be used to its full. Only last session they gave the necessary powers; so that the matter was *res judicata*. Then as to the Thames, it seemed to him far better to stick to the water they had, and construct storage reservoirs as they wanted them, and in the most economical manner, than to go to Wales or elsewhere, where directly the work was begun, the whole must be constructed, and for years they would consequently have an enormous outlay which would be absolutely wasted. They would incur expenditure the first ten years which would not be brought into use perhaps for twenty or thirty years. That was the drawback of the Welsh scheme. Regarding the question of waste, he remarked that it had been the curse of the London Water Supply for many years; and he hoped a real and serious endeavour would be made to check it.

Mr. J. Lucas thought it idle to discuss whether a certain large aggregation of human beings such as they were threatened with could exist on such a small space of the earth's surface; there was a limit to all things. He regarded as visionary the part of the paper relating to the quantity of water the Thames Basin was capable of producing. He considered the whole of the calculations were taken on too high a scale, which was not borne out by experience, by theory, or by the laws of hydraulics. In one respect, he was emphatically in accord with the author, and that was as to the paramount necessity of enlarging, and going

on enlarging, the storage accommodation. One point could not be too strongly impressed upon Mr. Middleton, as he might have great future influence in the matter. It was this, that no restriction whatever should be placed on the area of land to be used for impounding reservoirs, and that a strict limit ought to be found for the height to which the banks of these reservoirs should be allowed to be carried. It was not the extent of the water behind the dam, but the depth of water behind the dam, irrespective of area, that caused danger to the inhabitants lying below reservoirs. In further remarks, he agreed with other speakers that the time must come when it will be necessary for London to go to Wales.

Mr. H. Ashton Hill (South Staffordshire Water Company) said he considered Mr. Middleton's paper a most able advocacy of that which might be called the home supply as distinct from that which might be called the Welsh supply; but he must confess that, excellent as was the paper, he was not convinced. Mr. Middleton acknowledged that London would certainly have to go, in course of time, to Wales, or, at all events, somewhere else than the Thames and Lea Basins (say) in about half-a-century. If this were true, and he (Mr. Hill) had no doubt it was so, they could hardly begin too soon, for the necessary works might certainly be calculated to occupy at least some fifteen years in execution, and to this must be added time for the preliminary legislation—say, another five years. So that, in any case, consideration and preparation for the Welsh scheme could not possibly be deferred longer than 1941. This was the case even if they granted that all the water said by Mr. Middleton to be obtainable under the home scheme could be fully utilized according to his suggested plan. Having had a long experience in engineering deep well water supplies, he doubted much whether it was possible to obtain so large a quantity of water from deep wells as that indicated by Mr. Middleton, who proposed, in the interval between the present time and 1961, to augment the maximum supply to be taken from the Thames and Lea by no less than 384 million gallons a day derived from wells alone. Mr. Middleton must be a sanguine Engineer to feel confident of obtaining so enormous a volume of water from such sources. If it were procurable, the 384 million gallons would almost certainly involve the establishment of some 200 pumping-stations, or thereabouts. For each of these wells, there would be the great cost of sinking, with the certainty of many failures. For each station, there would be needed the erection of buildings, the installation of pumping machinery, and the laying down of the necessary mains. The whole would entail an enormous amount of constant supervision, and, for the entire scheme, a gigantic annual charge for upkeep and maintenance in proper repair. In fact, to those familiar with the details of a water supply dependent mainly upon deep wells, even the forecast of a scheme of such magnitude was calculated to almost take their breath away. Mr. Middleton could not, he thought, quote any instance of a pumping scheme involving more than about a tenth part of such a large number of pumping-stations; and because a score or so of pumping-stations had been worked satisfactorily together, it by no means followed that 200, or even 100, would. He (Mr. Hill) was therefore inclined to regard the scheme as complicated, an unworkable one, and one not justified by actual practice in the past. His own experience as Engineer-in-Chief of the South Staffordshire Water Company induced him to look askance at any such gigantic pumping scheme as that suggested. The area under his charge approached 300 square miles, and was some 40 miles by 20 miles between its extreme limits, with levels varying from 150 Ordnance datum to 900 Ordnance datum, necessitating pumping and re-pumping, sometimes twice over, for a considerable proportion of the supply. The present available yield was 10 million gallons per day, of which 3 million gallons was gravitation stream water, and all the remainder, 7 million gallons, from wells. There were thirteen distinct pumping-stations. Recently he had been engaged in obtaining underground well-water supplies at three different places within the Company's area, and had obtained a total for the three wells of from 5 to 6 million gallons per day. These new wells afforded exceptionally good yields as deep wells went in the new red sandstone. He had personal familiarity with fully a score of deep wells; and his experience in the control of districts where the bulk of the supply was from deep wells, impelled him to more than doubt the practicability of the author's proposal. He certainly thought the pumping scheme would need to be fortified by far more facts and very much more experience than water engineers had at the present time, before it would commend itself to anyone conversant with the difficulties and uncertainties that almost invariably beset a large scheme for supplying enormous quantities of water from deep wells. On the other hand, the Welsh scheme involved no uncertainties. Water engineers had had abundant experience of such schemes; and in these schemes of gravitation supply, almost every particular could be gauged or estimated beforehand. By carrying out such a scheme, London would have an entirely independent string to its bow; and there could be no question about the ability of engineers to bring the scheme to a successful issue. It would have its cost, of course; but even this could be calculated with a fair degree of accuracy. If Liverpool, Glasgow, Manchester, and Birmingham could afford to carry out such gravitation schemes, surely London would not be deterred from having the best scheme possible merely on the score of cost.

Mr. Cowper Cole, as an agent from the Welsh watershed, said the author had put down the average rainfall as 40 inches; but from rain-gauges he (the speaker) had access to on the Usk and Wye, he felt sure the figures ought to be 55 inches. He did not think the question of compensation had been sufficiently realized by engineers. The Wye was a rapid flowing river of some 130 miles in length in its main course, but it had no great commercial value as the Usk had in the way of the Newport Docks at its mouth or in the canal belonging to the Great Western Railway. But it had a considerable commercial value which affected the whole country, from the estuary to the head, in the way of fishing valuation, which would not be easily compensated. Just to give a rough idea of the value of the fishing, he might say that the Wye was the longest netted salmon fishing river in England or Scotland. That was not to its advantage, but to its disadvantage, so much so that the owners had formed an Association to hold the middle nets, and through the Association they had bought a portion of the nets in the estuary with the rights for £15,000. This would pay them 4 per cent. on the present rentals; and it showed the great fishing value of the river. If ever the Welsh scheme was adopted, a considerable sum would have to be added for damage to property. There had already been two Bills for the Welsh scheme; and he hoped there would not be another, because it was a serious thing for the landowners to be perpetually lodging petitions against the Bills. Some speakers seemed to think that the Welsh water was something very charming and soft. If they made careful inquiries, and asked Liverpool men who had Vyrnwy water how they liked it, how peaty it was, and how they are getting rid of the peatiness, a good many of them would pull very wry faces, and not say anything.

Mr. W. Morris (Kent Water Company) said there was one point that had not been talked about very much—that was, the question as to whether the population of London would increase so very rapidly as had been calculated. Of course, if it did not do so, it would be a great point in favour of taking up any future scheme for the supply of London in blocks, instead of incurring a vast expenditure all at once. He was glad to hear that one gentleman who advocated the lavish use of water, was willing to pay for it by meter, which was a most effectual way of preventing waste.

Mr. Walter Hunter (London) moved the adjournment of the discussion to the next meeting (Jan. 28); and this was agreed to.

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**The "Reports of Gas Associations" for 1900** is now ready. The volume comprises the reports of the several District Association meetings in the past year; the text of the papers being illustrated by four plates and 26 figures. The lists of officers and members are given at the end of the book; and there is an index to the contents. The volume is got up in the usual style.

**Natural Gas,** as already recorded in the "Journal," is giving out in the United States. It is estimated that 108,000 million cubic feet, equivalent in calorific value to 4,062,628 tons of coal, were utilized last year, but it is stated that to maintain even the present supply longer than another year or two will involve opening new fields and laying thousands of miles of piping. About 66 per cent. of the gas in the ground has been exhausted; and of that which carries a pressure of less than 100 lbs. comparatively little is likely to be available.

**Institution of Mechanical Engineers.**—The annual general meeting of this Institution was held last Friday evening; and, no doubt owing to the occasion being of exceptional interest, the theatre of the Institution House was filled. The retiring President (Sir William H. White, K.C.B., &c.) occupied the chair. The first business was the election of new members; and the magnificent addition of 120 was made to the already substantial list. The report, which was read by the Secretary (Mr. Edgar Worthington) stated that, at the end of 1900, the number in all classes on the roll was 3165, as compared with 2922 at the end of the previous year; showing a net gain of 243. During the year, there were added to the register 343 names; and the total deductions were 100, made up of 39 deceases during 1899, 43 resignations which took effect on Jan. 1, 1900, and 18 removals. Professor Burstall, it was also mentioned, expected to complete his second report to the Gas-Engine Research Committee in the course of a few weeks. For the first time, the award of the Willans premium was in the gift of the Council; and their choice fell on Captain H. Riall Sankey for a paper on "Governing of Steam-Engines by Throttling and by Variable Expansion," read in April, 1895. Captain Sankey had a splendid reception. Prizes were also presented to Messrs. Cleverley and Brees van Homan for the best two papers in the graduates' section. The result of the ballot for the election of officers was next announced by the President—his successor being Mr. W. H. Maw and the Vice-Presidents, Messrs. Keen and Richards. Mr. Bryan Donkin's name appeared among the new Members of Council; but for a year he will occupy the vacancy in the Vice-Presidency caused by the elevation of Mr. Maw. In a few valedictory remarks, Sir William White alluded to the great vitality of the Institution as evidenced by the large increase in membership during the past two years—close upon 500. The distinguished President then resigned his position to Mr. Maw, and received the hearty thanks of the members—his eminent services to the country and to the Institution being commented upon by the proposer, Professor Kennedy. The remainder of the evening was consumed by the further discussion of Mr. H. A. Humphrey's paper on "Power Gas and Large Gas-Engines for Central Stations," as reported elsewhere.

# CORRESPONDENCE.

*[We are not responsible for opinions expressed by correspondents.]*

## Coal Gas: Effect of Quality on Consumption.

SIR,—The full tabulated results of Mr. Dibdin's burner tests, made in connection with the above-named paper, have just been published in the "Journal of the Society of Chemical Industry." These include figures of some tests not furnished at the meeting of the Society last month; and I may now, perhaps, be allowed to emphasize the suggestion made in the discussion, that the moral of the paper was that the consumer needed educating as to the use of the most efficient burners.

In the paper in question, a No. 5 Bray was taken as the "average burner generally employed;" and estimates were given showing the cost with varying qualities of gas consumed through this burner. According to Table I., the "average burner" gave an efficiency of 11·8 candles with 16·2-candle power gas.

The whole of Mr. Dibdin's tables will in many respects be of considerable service to the gas industry. Their immediate chief use, however, appears to be to prove that the burner generally employed by the consumer is essentially the wrong one, since with the same quality gas—but with better flat-flame burners—higher results may easily be obtained.

Note the comparative tests of No. 5 burners, taken from Table I.: With 16·2-candle gas (as tested by the standard argand)—

| | Candles. |
|---|---|
| Sugg's table-top, No. 5, yields 15·3 candles with a consumption of 5·35 cubic feet; or, corrected on the 5-feet basis . . . . . | 14·3 |

| | Candles. | Cub. Ft. | | |
|---|---|---|---|---|
| Sugg's slit union, No. 5, | yields 15·3 | with 5·35 | or corrected | 14·3 |
| Peebles, No. 5 | ,, 13·0 | ,, 4·55 | ,, | 14·3 |
| Bray's union, with economizer | ,, 14·6 | ,, 4·95 | ,, | 14·7 |
| | | Average . . . . . | | 14·4 |

Against Bray's No. 5 burner, yielding 11·8 candles with 5·05 cubic feet, or corrected . . . . . 11·7

Whence, there seems the only inference that the sooner the consumer is educated to discard—or to use an economizer with—the present generally employed burner the better.

Assume, for a moment, the supply of 14·2, instead of 16·2 candle power gas, and the following deductions are made from the same table: With 14·2-candle gas (as tested by the standard argand)—

| | Candles. |
|---|---|
| Sugg's table-top, No. 5, yields 15·3 candles with a consumption of 5·7 cubic feet; or, corrected on the 5-feet basis . . . . . | 13·4 |

| | Candles. | Cub. Ft. | | |
|---|---|---|---|---|
| Sugg's slit union, No. 5, | yields 15·3 | with 6·7 | or corrected . . | 11·4 |
| Peebles, No. 5 | ,, 13·0 | ,, 5·5 | ,, . . | 11·8 |
| Bray's union, with economizer | ,, 14·6 | ,, 5·4 | ,, . . | 13·5 |
| | | Average . . . . . | | 12·5 |

Or (with the better burners) a *possible* average of. . . . . 13·45

Both averages obtained with 14·2-candle power gas are distinctly superior to the efficiency of 11·8 candles obtained with 16·2-candle power gas of the burner taken to be in general use.

I have found from experiment that even a slightly lower-grade gas consumed through a Bray's burner, provided with an economizer, will yield a better result than 16-candle power gas through the uncapped burner.

One comes, then, to the conclusion that the consumer is at the mercy rather of the gas-fitter than of the gas supplier, and that, to the public at large, enlightenment on the question of burners will be of far greater service, pecuniarily and otherwise, than a consideration of the technical subject of 16 *versus* 14-candle power gas.

In the meantime, Mr. Dibdin's undoubtedly valuable results suggest the fact—humiliating at this stage in the existence of the gas industry—that it is necessary to maintain the high-grade gas simply to keep up the credit of the generally employed, although comparatively poor, burners.

*Hertford, Jan.* 16, 1901. ROBERT WATSON.

## Gas-Fires.

SIR,—I trust you will allow me, as one of the earliest pioneers in the general introduction of gas-fires, to reply to some of your severe strictures on gas-fires, on p. 14 of your issue for Jan. 1.

As to their having "dropped into the shop pattern, to rest under the repute of being make-shifts," I think I am well under the mark in estimating the annual output of gas-fires as being well over 150,000. Of these, one-half go to gas companies, who hire them out; and the essential points for these are low cost, strength, non-liability to failure or accident, and (most of all) absence of expensive finish, which is liable to deterioration in use or in stock. The only finish permissible under these conditions is a thick, smooth varnish, which covers all fine details; and, under the circumstances, artistic work is totally out of the question. We have made, and still make, gas-fires in various bronzes and enamels—complete with mantels and overmantels, designed to harmonize; and we have employed artists of the first reputation to design for us. This we have done for the last fifteen years. The work, however, has been a labour of love—certainly not of profit—for the simplest possible reason: All houses, without exception, are fitted with coal-fire grates. They are practically all rented; and if the coal-fire grate is removed by a tenant, it has to be replaced when he removes. He has his costly artistic gas-fire on his hands; and the chances are ten to one that it will not fit in the required position in another house. Under the circumstances, it must of necessity be a make-shift; and, as a make-shift, the cheapest has the preference, almost invariably. Artistic and beautifully finished gas-fires are to be bought in many designs; but the demand is small, and most probably will remain so.

That the majority of gas-fires are "a caricature of a coal-fire" is a fact, determined by another fact, that purchasers will have nothing else. The best and most economical gas-fire ever made is the old and dead iron spray; and its economy and heating power show to the best advantage when turned down to half power or less—the state in which it is most required in daily use. Not one purchaser in a thousand will have these fires; and many thousands of them have been converted to ball fires. To offer one of them to a customer would be considered as an attempt to palm off old stock; and the dealer would most likely lose his customer, who would go to another shop, where he could get the newest "fashion."

A similar difficulty occurs in the manufacture of electrical heating appliances. The radiating plates at first introduced are now not satisfactory. The fashion and the universal desire is to have something which "looks" warm. Imagination plays a much larger part than would be supposed; and the incandescent glow-lamp, once highly praised for its very low heating power, is now coming to the front as a source of heat, in spite of the heavy cost. In this case the dealer has not to do with poor people or hirers; and the question of cost is a secondary matter. But still the demand is for a "sham," and nothing but a sham will satisfy customers. They will have something which "looks warm" like a fire; and the useful radiators are passed over with contempt, as being old-fashioned, and making the room "look cold."

The state of things is one which no maker can remedy; and, so far as can be seen at present, it is likely to be permanent. To try to lead customers the way they should go means bankruptcy.

If ever the time comes when gas is cheap enough to be used in the wasteful fashion coals are now used, there will be another and different future for gas-fires; but it does not appear likely that cheap fuel gas will solve the problem. The temperature of the flame is far too low to admit of the production of a bright fire, unless the pressure is very high, which means a noise and roar that would be quite unbearable under any ordinary conditions. Many fire-burners are made for fuel gas under a pressure of 4 or 5 inches, with fair results; the gas consumption being about 130 cubic feet per hour for a 12-inch wide fire. But the noise caused by the high pressure and rapid combustion is anything but pleasant to most people, although there are some persons who like myself) are partially deaf, and would not object.

*Warrington, Jan.* 15, 1901. THOS. FLETCHER

## Sale of Stock to Consumers.

SIR,—Gas companies are beginning to move in this direction. Within the last week, two Secretaries have applied to Mr. Bush for information, and have shown an evident desire to adopt the system. If this may be taken as an indication that the tide is beginning to turn, I should like to deal with the only difficulty in the way.

The auction clauses provide that any stock not sold by auction or tender is to be offered to the shareholders at the reserve price. To offer it to the consumers would give the go-by to the shareholders; and this, with some directors, will perhaps be a difficulty.

The South Metropolitan Company began the system ten or eleven years ago; and, notwithstanding the above provision in their Act, they have continued to work upon it. In no instance has any shareholder raised any objection whatever.

The fact is shareholders are clear-headed enough to see the great advantage it is to their property to have friends among the consumers. Moreover, the offering of stock at the reserve price is, as a rule, of very little, often not any, advantage to the shareholders, because the stock could be bought in the market at about the same price.

I have on various occasions explained the matter to our shareholders, who have always given their approval. Our Act of 1896 provides that unsold stock may be offered either to shareholders or to consumers or employees. This proviso obtained the assent of the shareholders, as has been the case with other Companies who have adopted it. This is conclusive proof that no objection will be made to the sale of stock to consumers.

*Jan.* 18, 1901. GEORGE LIVESEY

# LEGAL INTELLIGENCE.

## HIGH COURT OF JUSTICE—CHANCERY DIVISION.

### Tuesday, Jan. 15.

(*Before Mr. Justice* BUCKLEY.)

### Staines Reservoirs Joint Committee v. West Middlesex Water-Works Company and Others.

This was a special case stated for the opinion of the Court as to the construction of certain clauses of the Staines Reservoirs Act, 1896; the question involved being shortly whether the interest on the debenture stock of £1,003,500 raised under the Act, and certain management expenses, ought to be paid half yearly by the three Water Companies interested—viz., the West Middlesex, Grand Junction, and New River—or whether they should be paid out of capital account by the Staines Reservoirs Joint Committee until the works are completed, and the three Companies are drawing water from the reservoirs. Down to June, 1899, the accounts of the Committee were prepared on the former footing; but since then the latter plan has been adopted. The West Middlesex and Grand Junction Companies contended that this was the right principle; while the New River Company said the former method was correct.

Mr. NORTHCOTE represented the Joint Committee; Mr. WARMINGTON, Q.C., and Mr. R. J. PARKER appeared for the West Middlesex and Grand Junction Companies; and Mr. HALDANE, Q.C., and Mr. G. LAWRENCE for the New River Company.

Mr. WARMINGTON, having read the principal sections of the Act which incorporated the Committee, based his argument on certain

sections which provided that the three Companies were entitled to the stored water in equal proportions; but any Company might give six months' notice that they did not require to take their full quota, in which case the others might take the surplus between them. It was also provided that the three Companies should bear the management expenses, and pay the debenture interest, in proportion to the quantity of water they were entitled to take. In case of non-payment of interest, the debenture-holder was entitled to sue either the Joint Committee or any one or all of the Companies. The learned Counsel submitted that until the reservoirs were completed and the water was stored, so as to be available for use, the respective Companies were not entitled to any, and therefore the proportion in which they had to contribute could not be ascertained. The outgoings, therefore, ought all to be charged to capital account.

Mr. PARKER followed on the same side.

Mr. HALDANE relied on sections 79 and 83, which set forth that the costs, charges, and expenses of the Joint Committee in carrying out the Act should from time to time be paid to the Joint Committee half yearly by the three Companies.

Justice BUCKLEY held that the section which made the Companies liable to bear the expenses and interest half yearly was applicable now, and that it was not necessary to wait until the works were completed. The Companies were each equally entitled, although there was not as yet any stored water, just the same as they would be after the works were completed, although, owing to a drought, there might be no water available for them to take. He must therefore decide that the accounts as prepared down to June, 1899, making each Company liable for one-third of the debenture interest and the expenses, were in the right form.

## DEVON QUARTER SESSIONS.—Tuesday, Jan. 1.

(*Before Lord* COLERIDGE, Q.C., *Chairman, Lord* CLIFFORD OF CHUDLEIGH, *Major* DUNNING, *and Captain* BOLITHO, R.N.)

### Plymouth Corporation v. Guardians and Assessment Committee of Tavistock Union—Rating of Burrator Reservoir.

This was an appeal by the Plymouth Corporation against the assessment of their Burrator reservoir in Meavy, Sheepstor, and Walkhampton; but it had been agreed to take the three parishes as one. The rateable value appealed against in the parish of Meavy was £1446; in Sheepstor, £3715; and in Walkhampton, £586.

Mr. BALFOUR BROWNE, Q.C., Mr. H. E. DUKE, Q.C., M.P., and Mr. BODILLY appeared for the appellants; Mr. E. BOYLE, Q.C., Mr. BRODRICK, and Mr. LAWRANCE represented the respondents.

Mr. BOYLE, at the outset, said that as it had been agreed to take the three parishes as one, what they had to do was to arrive at the gross rateable value of the whole, and apportion it between the parishes. This was a matter of importance, because if it were only an appeal against the rateable value, they could not discuss the question of the gross estimated rental. The only question, therefore, could be whether the deduction made between the gross and the rateable value was sufficient.

Mr. BALFOUR BROWNE: We do not admit the gross valuation.

Mr. BOYLE said he must ask the Court to say that the appellants had admitted it by their notice of appeal. The appeal was simply against the annual rateable value; the appellants saying they were overrated in respect of the "yearly value" of the rateable property. There was no such thing as yearly value; but there was annual value, and this simply meant rateable value. It could not mean that they were over-estimated as to the gross rental. If they had wished to appeal in respect of both, they should have said that they were over-estimated as to the gross annual rental, and overrated as to the annual rateable value. He submitted that they were restricted to the question of the deductions made between the two.

Lord COLERIDGE: Might it not be said that the net annual value is incorrect, because the gross rental has been over-estimated?

Mr. BOYLE said that was so; but the appellants should have stated this if they meant it. If they complained of anything beyond the deductions, they should have so stated.

Mr. BALFOUR BROWNE said this was a purely technical point raised to quash the proceedings that day; and if the objection were upheld, they would simply have to give fresh notice of appeal. It seemed a pity that the point should have been brought forward, as they were not there to discuss technicalities, but to decide upon the value which was to be put upon the Burrator reservoir; and he thought both parties were anxious that this should be settled. The notice of appeal, however, clearly stated that the Corporation complained that they were overrated in respect of the yearly value of the rateable property belonging to them, and also that they were assessed in too large a sum for their property. This covered the two headings which were given in the assessment lists.

Mr. DUKE followed on the same lines.

Mr. BOYLE again submitted that no exception was taken in the notice of appeal to the estimate of the gross annual rental. Under 41 Geo. III. the appellants were obliged to state specifically the grounds of their appeal; and the Quarter Sessions could not allow any inquiry into a point which they had omitted.

Lord COLERIDGE said the Court were of opinion that the notice of objection covered an inquiry into the gross estimated rental.

Mr. BOYLE then said that for many years—from 1548, he believed—Plymouth obtained water from Dartmoor by means of a leat. The Corporation, under an Act passed in 1893, obtained powers to buy land and construct a dam, forming the great reservoir of Burrator; and the Assessment Committee had loyally done their best to avoid coming to litigation as to the assessment of the property. They said: "We only want what we believe to be fair; and if you will give us your figures, and tell us what you think would be fair, we will discuss the matter with you, and try to come to an arrangement." Up to that moment the Corporation had never disclosed the figures at which they considered they ought to be assessed; and therefore it was impossible to come to any agreement. The Committee were under great difficulties, because they had to form their estimate largely on the published accounts of the Corporation; and it was not easy to get at the actual outlay on the reservoir. He thought it would be found that the Committee had very much under-estimated the money expended, and the estimate was at the same time very much higher than the rateable value appealed against. What one was generally guided by was the rent a hypothetical tenant would pay; but in this instance they had to take the structural cost, and put a certain percentage upon it. The points around which the discussion would centre were these: First of all, what was the cost and what the value of the land; secondly, what was the rate of interest to be calculated on this capital sum; thirdly, how was the total sum arrived at to be divided among the three parishes; and there might be a fourth—whether the reservoir was very much larger than the necessities of Plymouth or the district required at the present time. He did not think, however, there would be any dispute as to the apportionment.

The following evidence was then given in support of the assessment:—

Mr. *G. Humphreys Davies* said he had surveyed the Burrator works; and his first valuation, made in January, 1900, was: For Sheepstor, £4799 gross and £4173 rateable; Walkhampton, £731 gross and £635 rateable; and Meavy, £2347 gross and £635 rateable. The total was £7882 gross, and £6468 rateable. At the meeting of the Assessment Committee of the Tavistock Union on the 9th of March, the Corporation appeared in support of an objection to the assessment; but no particulars were given by the Town Clerk which would induce the Committee to reduce the assessment. He confined himself simply to the notice of objection. The Committee were anxious to avoid a contest, and decided to reduce his (witness's) assessment by 10 per cent. This made the gross value £7231 and the rateable value £5871. Taking the population of Plymouth and other places to be provided for at 130,000, he allowed a consumption of 47½ gallons per head per day, which meant a total daily quantity of 6,744,000 gallons. The rainfall during a period of drought over the gathering-ground was 5½ inches. Supposing the reservoir to be three-parts full at the commencement of the drought, it would be practically emptied in 115 days; and if it was quite full, in 130 days. Bradford showed lately a store equal to 148 days' supply; therefore he did not consider the Plymouth reserve by any means excessive. Although a reduction was made by the Committee, he thought his original valuation was a correct one. He took the cost of the dam and works at £115,453; new and substituted roads, £10,089; plantations, £3605; parliamentary expenses for Acts of 1883 and 1897, &c., £15,000; and he estimated the total outlay at upwards of £150,000. He put the annual value at 4 per cent. and got £7440; and there were in addition the values of various works, such as piping.

In cross-examination, witness said he had based his calculations upon the total cost of the works, the figures of which had been supplied him by the Corporation. He felt quite justified in taking into account parliamentary and previous experimental expenses, as they were absolutely necessary. He had taken the land at its reservoir value, and had reckoned the percentage on the outlay at 4. He knew Plymouth had borrowed at 2¾, and afterwards at 3 per cent. They were paying on their last loan £3 8s. 2d. per cent.

Mr. BALFOUR BROWNE quoted the prices paid for the last few years, and stated that the average was only £3 0s. 6d. per cent.

In further cross-examination, witness said he was not a water engineer, and had never had anything to do with the construction of waterworks. If there was a reservoir containing 100,000 gallons, and only 50,000 gallons were used daily, he should reckon such an excessive supply in calculating the rateable value. The allowance of 47½ gallons per head for Plymouth was not excessive, but it was the highest. He could not mention any town where it was so high. He did not know that, upon the proper basis of rainfall, there was an excess supply of 3,750,000 gallons a day.

Re-examined: He had taken the lowest quantity of water at the command of the Corporation. It was wrong to take an average, because sometimes there might be a much larger demand than could be dealt with. He thought the cheapness of water at Plymouth was an inducement to use it lavishly. He adhered to his statement that every £100 that had been spent on the Burrator reservoir was costing Plymouth £3 8s. 2d.; but in making his calculations he was not guided by what the Corporation paid for their water rights. He took them at their value at the present time, and under existing conditions. His total valuation in the first instance was £7932. The rateable value appealed against was £5827; and he considered the property was underrated.

Mr. *Herbert Fuller* said he entirely agreed with Mr. Davies in his valuation. He also considered that any sum spent in experimental works, such as had been done in this case, should be taken into account in fixing the rateable value. He made this £8100 for the three parishes concerned; and he thought that if the Assessment Committee had known all the circumstances they did now, they would not have put their assessment so low as £5837.

## Wednesday, Jan. 2.

On the resumption of the proceedings this morning,

Mr. *E. P. Seaton*, Consulting Engineer of the Cranbrook District Water Company, was called. He said that, having regard to the quantity of water used per head in Plymouth (47½ gallons), and the obligation of the Corporation to supply ships in the harbour, the storage capacity at Burrator (651 million gallons) was not excessive. He considered £160,000 was a moderate figure for the cost of these works. It was 7 per cent. higher than the Engineer's parliamentary estimate. The cost of raising the dam 3 feet would be between £5000 and £6000.

Cross-examined: The storage at Plymouth was provided for 25 years ahead; and this was prudent.

Mr. BALFOUR BROWNE, in opening the appellants' case, said the exceedingly simple question was what rent might reasonably be expected from the reservoir in question. One of the means for finding this out was the cost of the works; and there was the question of how much of the amount spent in making provision for 25 years was fairly effective to-day.

Lord COLERIDGE: Would not the rating then go up year by year?

Mr. BALFOUR BROWNE said it probably would do every few years. The rating would grow as Plymouth grew. One huge fallacy into which the respondents had fallen was the rating of Plymouth at £25,000 for water rights for land above the dam, whereas all the rights the Corporation possessed there were those of an ordinary riparian owner. Under the 1893 Act, the Corporation bought the land at a price which worked out at £43 an acre—a very fair sum. Cost was usually the measure of value. He contended that 47½ gallons per head of the population of Plymouth was excessive; and the water there was allowed to run to waste, because it was felt that it might as well flow through the pipes as through the stream. They had 3 million gallons a day running to waste. Compared with other towns, the supply per head in Plymouth was excessive.

The following evidence was then given for the appellants:—

Mr. *E. Sandeman*, who was formerly Water Engineer to the Corporation, and designed and constructed the reservoir, said its cost was £127,347, including the roads. The figures appeared in the Corporation accounts as £185,043, because other things were included. The possible output from the reservoir was 8¾ million gallons per day. The storage capacity was 637 million gallons. In designing the reservoir, he looked ahead 25 years. The present population supplied from the reservoir was 125,000. The outside requirements he would provide for would be from 30 to 35 gallons per head per day. In 1898 he reduced the supply to 38 gallons per day as an experiment. There was an abundant supply; and it was allowed to run through the pipes, and enormous waste occurred. A reservoir half the size of the Burrator would be sufficient for the present requirements of Plymouth. In 1896—the driest year for 30 years—during the four driest months the water which ran off was 530,000,000 gallons, or 4,300,000 gallons per day; and 2,880,000 gallons was the smallest flow on the driest day. A reservoir could have been built for present-day wants for £80,000.

In cross-examination, witness said his estimate of £150,000 included land and parliamentary expenses. The cost of the Burrator reservoir was £185,000, including the pipe-line to Roborough and other works, but not any rights which the Corporation had under Elizabeth, the £16,000 paid for land, or rights for getting water from the Meavy and its tributaries. The Corporation claimed to have the benefit of 5000 acres of watershed.

Re-examined: If there were a greatly increased demand for water, it would be easy to decrease the supply per head. He need not have constructed the Sheepstor dam; but he thought it could be done for £5000, and he wanted to make one job of it.

Mr. *Arthur Body* put the rent of the Burrator reservoir at 2 per cent. upon the capital outlay.

Mr. *Arthur Ryde* and Mr. *W. Eve* agreed; the latter witness stating that no contractor would undertake the work at this figure.

Mr. BALFOUR BROWNE, in summing up, contended that the basis of cost should be £127,000, and that regard should be had to the fact that the property at present was only effective as to two-thirds of the whole.

Mr. BOYLE replied that, according to the published accounts of the appellants, the Burrator reservoir and water-works cost, after making certain deductions, £175,000. The property must be assessed at the value it was to the tenant from year to year for the purpose for which it was used. Interest, cost of parliamentary powers, &c., should be included in the cost; and if anyone could take the property, he would be glad to do so at £7000 assessment instead of the £5000 appearing in the list.

The CHAIRMAN announced that the Court had decided to take as the measure of value of the land the amount that was paid for it; that all land owned by the Corporation at Burrator, whether covered by water or not, must be taken into consideration; that the cost of obtaining parliamentary powers and the interest on capital during construction should be added; that the piping from the reservoir conveying the water to Plymouth, so far as it was laid within the Tavistock Union, should be rated; and that there should be some deduction for the excess of capacity of the reservoir beyond the present requirements. The cost of the undertaking was fixed at £183,234. The Corporation paid £3 5s. 4d. per cent. on the amount received in connection with the last loan. The Court deducted the odd 5s. 4d. now in respect of the surplus capacity, and held that an amount equal to 3 per cent. on the £183,234 roughly was the sum at which the Corporation should be rated in the books of the Union. On this basis, the assessment worked out to between £5400 and £5500; and the appellants were, therefore, assessed too high at present, because the assessment in the books of the respondents was £5827. The appeal must, therefore, be allowed; costs to follow the event.

It was agreed that, if required, a case should be stated on the preliminary objection taken by Mr. Boyle as to the scope of the appeal.

## LINCOLN COUNTY COURT.—Monday, Jan. 14.

(*Before His Honour Judge* SHORTT.)

### Coal "Contracts" and Rising Markets.

At the sitting of the Court to-day, the hearing took place of an action brought by Messrs. Warrener and Sons, of Lincoln, coal merchants, against the Navenby Gas Company for £18 1s. 6d., for coal supplied. There was a counter-claim for £28 15s. 7d. for an alleged breach of contract.

Mr. A. B. PORTER, in opening the case, said the question really between the parties was whether any contract was entered into for the supply of coal to the gas-works at Navenby. If his Honour decided in favour of the plaintiffs, that there was no contract, then the counter-claim went, and the claim stood good. For some years plaintiffs and their predecessors had entered into contracts with the defendants for the supply of coal. When such contracts were made, the plaintiffs entered into countervailing contracts with the colliery with which they were dealing. The last contract ran out in July, 1899; and on May 26 of that year, a quotation was made by Mr. A. C. R. Warrener, as follows: "On the expiration of the present contract, I shall be pleased to supply you with gas coal for the next twelve months at 11s. 6d. per ton, colliery weight, delivered at Navenby Station at such times and in such quantities as you may direct, on the usual terms and conditions." That was sent to the defendant Company. Two or three days afterwards the Manager of the Company (Mr. Atley Barnes) went to the plaintiffs' office, and definitely refused to accept the contract. He said the price was too high; and although he was urged by Messrs. Warrener to enter into a contract, because the probability was that the coal would go up in price, Mr. Barnes declined to do so. Mr. Warrener, at his request, saw the colliery people, to know whether he could reduce the price. Mr. Barnes was again urged to make the contract, but refused; and as a consequence there was no contract. In previous years there had been (either verbally or in writing) a definite understanding. On the present occasion, however, there was none; but there was a definite rejection on the part of the defendant Company. On Aug. 2, 1899, Mr. Barnes went to the plaintiffs' office, and, without any reference to a contract, ordered two trucks of coal. These coals were sent; and further orders were given during the year. The coals so ordered were sent at the market price, which happened to be 11s. 6d. per ton. About the end of December the price went up; and then notice was given to Mr. Barnes that the colliery had raised their price, and that the plaintiffs would want an increased price from him. He then for the first time asserted that he had made a contract. In his answer to interrogations, Mr. Barnes contended that the contract was made when he ordered the two waggons in August; but Mr. Melton, to whom the order was given, stated that there was no mention at the time of any contract. He (Mr. Porter) wanted to point out to his Honour that where contracts were entered into by local merchants for a fixed price, especially when they had knowledge that coal was going up, they always entered into a counter contract with the colliery. Even assuming that in August there was any reference to a contract, at that time it was too late to get a covering quotation from the colliery, and it was unlikely then that any such contract would be made.

Mr. *A. C. R. Warrener* stated that Mr. Barnes refused to enter into a contract; and it was not until he had notice of an increase that he said he had accepted the offer of May, and regarded it as a contract.

In cross-examination, witness said he had confirmed previous verbal contracts in writing. He told Mr. Barnes several times he would have to take market risk, and urged him to make a contract. Between August and December there was a rise in the price of coal; but the colliery executed his orders up till then, and he supplied the defendant Company at 11s. 6d. a ton. Then he had notice from the colliery of an increase, and wrote Mr. Barnes that the colliery repudiated any contract with the plaintiffs, as the arrangement was only verbal, and informing him that the last truck supplied, and any in the future, would be charged at current rates. There was absolutely no arrangement to supply at 11s. 6d.

Other similar evidence having been given,

Mr. WALKER, for the defendants, said the whole question was whether or not Messrs. Warrener were under contract to supply coal at 11s. 6d. a ton from July, 1899, to July, 1900. What had taken place in previous years was material as throwing light on the conduct of business between the parties. In previous years an offer, almost on the same terms as the one read in Court, had been made in writing by Messrs. Warrener, and had been verbally accepted. His friend said there had been confirmation of these offers; but no such written confirmations were in existence. The offer in question was made a considerable time before the contract came to an end; and there was thus ample opportunity for the parties to discuss the question, and see whether any alteration in the agreement could be made. When Mr. Barnes failed to get a reduction, he gave an order for two trucks at 11s. 6d.; and the inference was that the contract was agreed upon. Coal was supplied from time to time at that price, until the colliery raised the price to Messrs. Warrener. All through the autumn the market in coal was fluctuating; and yet Messrs. Warrener did not increase the price to the Company until January, when they sent the coal at current rates. He contended that the inference was irresistible, that the plaintiffs regarded their offer as standing good until the time the colliery increased the price to them—giving as the reason that the arrangement was only verbal; and then Messrs. Warrener used the same argument to the defendants. As between Messrs. Warrener and the defendants, no writing was necessary if he could satisfy his Honour there was a verbal contract.

Mr. *Barnes*, Managing Director of the Navenby Gas Company, gave evidence, and said that in the two previous years the offer of Messrs. Warrener was accepted verbally by him. In May, 1899, the offer was at a higher rate, and he discussed the price with Mr. Warrener. He considered he accepted the offer, and that it amounted to a contract when he ordered the two trucks in August.

Cross-examined, he said he never refused the offer; he simply asked if it could not be done for less. When he ordered the two trucks, he did not know whether he used the word contract; but he said he expected the price would be 11s. 6d.

His HONOUR: Were you under any obligation to buy your coal from the plaintiffs?

*Witness:* I consider so.

What sort of obligation?—That I had accepted the contract.

His HONOUR said the point he had to decide was whether there was a contract binding upon the plaintiffs to supply the defendants with coal for a year. There was no evidence upon which he could find any such contract. In the first place, the offer was made by letter on May 6, 1899, and a figure quoted. The two plaintiffs were positive that Mr. Barnes never did accept this contract; and he said he did by giving an order in August, when he saw a clerk of the plaintiffs, and not one of the plaintiffs personally. He (Judge Shortt) did not consider that a sufficient acceptance, or that it ought to be held as a sufficient acceptance, of a contract to supply coal for the whole twelve months. The letter was as early as May 6 for the reason that if the contract was accepted the coal merchants could make a subsidiary contract with the colliery companies. It was very unfair to leave the matter two or three months, and even then, without formally saying to one of the partners, "I accept your offer," just see a clerk and simply order some coal, mentioning a price of 11s. 6d. On the evidence, he could not possibly find there was a contract binding upon the plaintiffs. The plaintiffs were wrong in charging more than 11s. 6d. on any coal delivered prior to apprising the defendants of the increase; and he was

doubtful whether that only referred to one or both trucks, with the last of which the note was despatched.

Mr. WALKER was arguing that the reduction should be made on both, when

Mr. PORTER interposed, and said his clients were agreeable to accept the 11s. 6d. per ton on both trucks.

A verdict was then entered for £10 4s. 5d., and the counter-claim was dismissed, with costs.

## Alleged Pollution of Water by Gas.

In the Chancery Division of the High Court of Justice last Friday, Mr. Justice Farwell had again before him the motion for an injunction to restrain the Tunbridge Wells Gas Company from allowing gas to escape from their mains and pollute the water in adjoining pipes (see *ante*, p. 153). Mr. Jenkins, Q.C., who represented the Company, said the gas-main had been stripped, and also the water-pipe. According to the report of the experts, which had just been received, but had not been verified, there was no leakage which could possibly be repaired; but it was the fact that wherever there was a gas-main a certain quantity of gas—enough to create an odour—permeated into the adjacent soil. The complainant's water-pipe was immediately alongside the gas-main, and was very defective; and it might be that some of the odour of the gas had been absorbed. Under these circumstances, of course, the Company must contest the case, because, if there were no negligence, they would not be liable. His Lordship suggested that the question was one for trial; and Mr. Upjohn, Q.C., for the plaintiff, agreeing, it was arranged that the statements of claim and defence should be delivered immediately, and the case set down for trial.

## Colliery Fined for Non-Delivery.

In the Queen's Bench Division of the High Court of Justice last Friday, Mr. Justice Mathew gave judgment in a commercial case which had been before him earlier in the week. It was an action brought by Messrs. Rickett, Smith, and Co., Limited, who are now amalgamated in the firm of Messrs. Rickett, Cockerell, and Co., to recover damages from the Mapperley Colliery Company, Limited, for the non-delivery of coal under a contract for the supply of 5000 tons of hard coal at 8s. 6d. per ton of 20½ cwt., to be delivered in waggons at the defendants' colliery in equal monthly instalments until May 31, 1900. Equal monthly deliveries would be about 450 tons a month. The evidence showed that the defendants had delivered 2446 tons in the period, leaving 2554 tons; and, after the date on which the contract expired, they refused to deliver the balance. By their defence, they alleged that the plaintiffs had not supplied waggons to receive the coal at the colliery, which, according to the defendants, it was the purchaser's duty to do; and they counter-claimed £151 10s. for demurrage on trucks alleged to have been kept for unduly long periods, at the rate of 3s. a day per truck. Evidence was given in regard to the course of business as to the supply of waggons by sellers and purchasers under contracts for the delivery of coal into waggons, and as to the fluctuations in the price of coal during 1899-1900, in order to prove the damages sustained by the plaintiffs. It was shown that from October, 1899, coal of the description in question rose in price rapidly—about 1s. a ton per month, and that from February to April, 1900, the figure stood at 15s. to 17s. per ton. His Lordship decided that the plaintiffs had not been in default, and that it was owing to the fact that the defendants had not fulfilled their part of the arrangement that all the coal had not been delivered. The damages payable to the plaintiffs would be the difference between the contract price and 15s. a ton. With regard to the demurrage, the defendants had made a claim for £150. This was an exaggerated amount; and he held that they were only entitled to 18 guineas. He gave judgment for the plaintiffs on the claim, with costs; and for the defendants on the counter-claim, without costs.

## Prepayment Gas-Meter Improvements.

Before Vice-Chancellor Hall, at the Sittings in Liverpool of the Chancery of Lancashire yesterday week, an application was made by Mr. Tweedale, in the matter of Ward, Whitham, and Co. and Large *v.* Whitham, for an injunction to restrain the defendant from selling or disposing of certain letters patent until the trial of the action or further order. Defendant was not represented, but notice of the motion had been served on the preceding Saturday. The facts, as stated by Mr. Tweedale, were as follows: The plaintiff Company, of which the defendant is the Managing-Director and Secretary, carry on business as gas-meter manufacturers, &c., at Oldham; and the plaintiff Edward Large was the inventor of certain improvements in prepayment meters. These improvements Large perfected early in 1899, and then advertised for some company engaged in the manufacture of gas-meters, &c., to join him in patenting the improvements and manufacturing meters with such improvements. He shortly afterwards received communications, and subsequently a call, from the defendant, who introduced himself as the Managing-Director of the plaintiff Company, and as such negotiated with him, the result of which was that defendant agreed that the Company should purchase the improvements for £20 and a royalty of 9d. per meter, he (Large) to go to Oldham and superintend the manufacture. This he did; the Company paying his wages. On March 13, 1899, Large signed an application for provisional protection in which the names were blank. A little later he saw an announcement that such application had been made in the names of Challenger Whitham and Edward Large, and called the defendant's attention to it. The reply was that the Company could only deal with him (Large) through himself as Managing-Director, and that it was all right. This explanation satisfied him; and later on, being asked to sign an agreement as between himself and defendant, he did so on the same explanation being given. The Company had ratified the agreement with Large, and paid him the royalties due. It was only quite recently—within the last few days—that they had learnt that the defendant claimed to be joint patentee in his own person. Mr. Tweedale read affidavits by Messrs. Large and Haworth (Chairman of the Company) in support of the plaintiffs' case. After some discussion, the Vice-Chancellor said that as the defendant had not seen fit to appear, though charged with what amounted to misrepresentation and fraud, he granted the injunction over the following Monday (yesterday), and then, if there was no explanation, it would be continued until the trial of the action

## Claims for Compensation.

At the Marylebone County Court on Monday last week, before Judge Stonor and a Jury, Matthew Davies, a riveter, sought to recover damages, under the Employers' Liability Act, from Messrs. Willey and Co., of Exeter and London, in respect of personal injuries sustained by him owing, as he alleged, to negligence for which they were responsible. Mr. V. D. Knowles appeared for the plaintiff; Mr. E. F. Leaver represented the defendants. The plaintiff's case was that on the 16th of August he was employed by the above-named firm to assist in constructing a gasholder at Wokingham; and the foreman on the job—a man named Giddings—instructed him to erect a scaffolding inside the structure. One of the planks supplied was about 2 feet too long; and he had two men to help him shift it to a position which would have been occupied by one of proper length. One end of the plank was securely fastened to the scaffolding in the centre of the holder, and the other was being brought into position by the two men pulling a rope attached to the loose end. He stepped upon the plank to get his hammer; but just then Giddings called away one of the men, named Prout, who had been holding the rope, and as the other was unable to bear the strain, it loosened, the plank slipped, and plaintiff was precipitated to the ground. By the fall he sustained injuries to his right knee and arm. He was kept for 16 days in a hospital at Reading, and had not been able to do any work since. His wages had been 36s. a week; but he sometimes earned as much as £3 a week. In cross-examination, he acknowledged that the poles and planks were perfectly proper ones. What he complained of was that Giddings called away Prout. Dr. Chambers, after describing the plaintiff's injuries, said he thought the man would be able to resume his work in about a a month or six weeks. Arthur Sharpe, one of the men who held the rope, said that Davies started swearing, and then Prout told plaintiff to pull the rope himself. In answer to his Honour, witness said no one called Prout. Mr. Leaver said this was just his case. He had numerous witnesses who would give the same version of the affair. For the defence, Henry Giddings, the foreman on the job, emphatically denied having called Prout away; and Prout himself testified to this. He said Davies began swearing; whereupon he (witness) told him to come and pull the rope himself. Mr. E. R. Johnson, the Clerk of Works, said he was with Giddings about the time of the accident, and did not hear him call Prout away. The Judge, in directing the Jury, pointed out that plaintiff's case stood practically on his own evidence, and that his story was not only contradicted by the witnesses on the other side, but also by one of his own witnesses. The balance of the evidence was therefore clearly against him. The Jury, however, returned a verdict in his favour, on the ground of "the insufficiency of the materials and want of proper labour." The Judge: I grant a new trial at once. What you say has nothing whatever to do with it.

At the Bolton County Court, before Judge Bradbury, a few days ago, a case was heard under the Workmen's Compensation Act, in which the Bolton Corporation were sued by Sarah Grundy for £171, representing compensation for the loss of her husband, William Grundy, a labourer at their Gas Street station. Deceased was carrying an iron screen across a plank, when it caught against a wall and overbalanced him, with the result that he fell into a fire-hole, a distance of 5 feet, fractured a rib, and sustained a severe shock, from the effects of which he died next day. His average weekly earnings were £1 2s. Mr. Horridge, who represented the applicant (who is deaf and totally blind), said the Corporation had dealt very fairly in the matter—having agreed to pay the widow £100 clear, as there had been some doubt as to whether Grundy had died from the accident or from natural causes. The Judge said he had a great objection to paying out a lump sum. It was of the greatest importance to the young children that the money should not be squandered. He would grant the widow £20 down, and the balance at the rate of £2 per month, with leave to further apply.

## Coin Meter Pilferers at Salford.

At the Salford Police Court on Monday last week, four youths—by name Carruthers, Nolan, Crane, and Crook—were charged with a series of thefts from coin gas-meters in various parts of the borough. The police had received numerous complaints; and in consequence a thorough investigation had been made into the matter. It appears that the defendants effected an entrance into houses during the absence of the occupants; and in one case had robbed the gas-meter to the extent of 18s. 8d. The Bench were informed that Carruthers had a bad character, and was undoubtedly the ringleader. The Stipendiary said it was no doubt due to the influence of Carruthers that the other boys had been brought into the case; but they were old enough to know better. Carruthers, it was evident, was determined to live a life of crime; and he would be imprisoned for six months, with hard labour. Crook was sent to gaol for a month; and, there being nothing known against Nolan and Crane, they were bound over in their own recognizances to come up for judgment when called upon.

In the Nisi Prius Court, Dublin, last week, Mr. Justice Kenny and a Jury had before them for three days a claim by Messrs. J. H. Parker and F. J. Allan, trading as the Irish Associated Press, against Messrs. Tully, Marsh, and Bowden, in respect of work done for them in connection with the promotion of the Irish Provincial Gas Company, Limited. The amount in question was £906 14s. 11d. Mr. Tully pleaded that if any work had been done for him, it was as agent for Mr. Marsh; while this gentleman denied that any work whatever had been done. Mr. Bowden did not put in any defence. The Jury gave a verdict for the plaintiffs for the amount claimed, less £7 10s.—reducing it to £889 4s. 11d.—with costs.

# MISCELLANEOUS NEWS.

## GLASTONBURY GAS ARBITRATION.

### Surveyors' Institution, London—Friday, Jan. 18.

(*Before Mr.* C. HAWKSLEY, M.Inst.C.E., *Umpire.*)

The proceedings were resumed to-day in the arbitration, commenced on the 8th inst. (*ante*, p. 154), to decide the amount to be paid by the Glastonbury Corporation for the undertaking of the Glastonbury Gas and Coke Company, power to purchase which was conferred upon them by an Act passed last session. Mr. W. A. M. VALON, J.P., was Arbitrator for the Company; Mr. ALFRED COLSON, M.Inst.C.E., for the Corporation.

Mr. BALFOUR BROWNE, Q.C., appeared for the Company; Mr. WEDDERBURN, Q.C., represented the Corporation.

Mr. *John Bishop* said he had been Secretary to the Company since 1893, and from April last had generally managed the undertaking; the technical part of the work of gas production being done, since the latter date, by the foreman. In 1893, the share capital was small; and, as regarded extensions, the Company were tied up for money—the result being that they were made wholly out of revenue. This practice continued until 1899. In 1894, Mr. Willey advised that, preliminary to extending their works, they ought to put in another holder. This was primarily paid for out of revenue, but was afterwards taken out of both sides, and put into the capital account. At that time the Company were not doing any considerable business with Street. Owing, however, to developments in Street, the Company in 1899 put out a contract for £3000 or £4000 for the maining of the side streets of the place. The mains were, however, not connected until 1900; so that in 1899 (the year of account), the Company had no advantage from these extensions. Before the Company supplied Messrs. C. & J. Clarke, with whom they had a special contract, that firm made their own gas, and supplied a few other people. The great increase in consumption in 1900 was due considerably more to ordinary consumers than to the large ones, with whom there were special contracts as to prices, depending on the varying cost of coal. The special-rate consumers in 1900 took 2,688,100 cubic feet, an increase of 1,320,000 feet over 1899; the private consumption in the same period increased by 1,600,000 feet. In 1900, Street having further developed, the Company opened a depôt for stoves there; the demand in that place being for stoves and for fitting up houses. At Dec. 31, 1899, the number of stoves out was 109; and at the same date in 1900, 243—an increase of 134. The number of consumers in Glastonbury in 1899 was 267, and in 1900 314; and in Street in 1899 109, and in 1900 189—making a total of 503 in 1900, as compared with 376 in 1899. Meters had also increased; the number in 1899 being 373, and in 1900 495.

Cross-examined by Mr. WEDDERBURN: Messrs. Clarke (one of the special-rate consumers) took 24,200 cubic feet in 1899, and 1,384,900 cubic feet in 1900.

Mr. WEDDERBURN: The difference of special-rate consumers then, taking Clarkes alone, is greater than you gave us for all such consumers. You told us that the special-rate consumers burnt 1,320,000 cubic feet more in 1900 than in 1899; now you say that one of them alone consumes 1,380,000 feet more?

*Witness:* The other special-rate consumers burnt less.

Mr. WEDDERBURN: So that, but for Clarkes, business was decreasing?

Mr. BALFOUR-BROWNE: That is among these special people.

*Witness:* That is so.

Cross-examination continued: Some of the special-rate consumers increased and some decreased; but taking them altogether, there was a total increase of 1,320,000 cubic feet. He denied that details of the increases and decreases showed that the general trade between 1899 and 1900 was decreasing. As regarded one firm who took 81,000 cubic feet less gas in 1900 than in 1899, there were reasons which entirely explained the decrease. In 1899, the firm ran their own engines, and consumed a considerable quantity of gas. Then they put down plant and made their own gas. In the late autumn of 1900, witness, however, succeeded in getting hold of them again; and they had now shut down their own plant, and commenced taking gas from his Company, under a special agreement. He could give no explanation with regard to similar decreases which had occurred in the two years in the case of Messrs. Bailey and Messrs. Moreland. He could not say what the profit was on Clarkes' contract in 1900; but he did not know that there was a loss. The cost of the gas would be about 3s. per 1000 cubic feet, he thought.

Mr. WEDDERBURN said he was going to show that there had been a loss under the contract with Clarkes.

In further cross-examination, witness agreed that, with coal at 15s. 8d., the price to Clarkes would be 2s. 7d. per 1000 cubic feet; and that the cost of coal and working expenses was said in the tables to be 3s. 1¼d. per 1000 cubic feet. The latter figure, however, witness held, related to the sale, not the make, of gas; the cost should be taken on the make, not on the sale.

Mr. BALFOUR BROWNE pointed out that the 3s. 1¼d. included such items as repair of meters and depreciation of stoves; whereas Clarkes had their own meter, and did not use stoves.

Mr. WEDDERBURN: All these figures had to be brought in, in order to ascertain, according to your own showing, what it has cost you to produce gas.

Mr. BALFOUR BROWNE: What it cost us to supply gas to an ordinary consumer. We do not think there has been a loss at all.

In re-examination, witness said that, as in every other gas concern, there had been fluctuations in the amount of gas consumed. On the whole, there had been a substantial increase in the year—chiefly due to Clarkes, whose supply was taken mainly during the day, which was of very great importance.

Mr. *J. C. Moreland*, a Director of the Company since 1898, gave evidence regarding the late Manager. All contracts beyond a certain amount would have had to go before the Secretary. As to small quantities of coke sold for cash, the late Manager had an absolutely free hand.

*Mr. Joseph Cash*, Engineer and Manager of the Brighton and Hove Gas Company, said the works were substantially built, and the greater part of them was practically new. He calculated they could produce 40 per cent. more gas than was made at present; and the output, with a slight additional expenditure, could be doubled. The working during 1899 was undoubtedly bad, and showed want of care in management. The make of gas per ton of coal was much lower than it ought to have been; the unaccounted-for gas was heavy; and the percentage of fuel consumed was much higher than in any case he had known. The expenditure on repairs also was very heavy. The principal growth of the Company had undoubtedly occurred in the Street district; large manufacturing extensions having been made there, and houses erected for the workpeople connected with the local manufactories. The sale of gas in Street would show a rapid increase in future. The Company had this year for the first time declared their full standard dividend, and if the transfer had not taken place would have continued to do so The initial figure of his valuation was the profit shown for the year 1899, £596 16s. 4d., which, however, required correction. The coke used was 549 tons, out of 961 tons produced, or 57 per cent. This percentage should be 25; and then there would have been 301 tons more coke sold, which, at 10s. 6d., equalled £158 0s. 6d. The amount spent on repairs and maintenance (8·08d. per 1000 cubic feet sold) was excessive, and should not have been more than 6d.—leaving 2·08d. over-spent, which, on a sale of 13,464,000 cubic feet, meant a saving of £116 13s. 8d. The amount for stationery, general establishment, law, and bad debts was exceptional, and should be 0·6d.—leaving 1·01d. over-spent, which (calling it 1d.) equalled £56 4s. These three figures, added to the £596, made the maintainable profit £927 14s. 6d., which could have been materially increased if the leakage had been a fair amount. He calculated the structural value of the concern to be £17,933; and the parts in excess he valued as follows: Land £333, retorts £1400, condenser £60, purifiers £78, station-meter £75, gasholders £680, buildings (except retort-house) £300, and mains in districts £390—a total of £3316. He made no allowance in regard to the engines, exhausters, boilers, washer, scrubber, governors, weighbridge, services, meters, stoves, or lamps. Although the exhauster was in excess of the maximum make, a second one was desirable, as a matter of safety. If necessary, the two larger holders could be telescoped at moderate expense, and thus their capacity would be nearly doubled. The Company had largely developed their undertaking at the expense of the dividends, and had now entered upon a period of full dividends, and he thought their prosperity was just beginning. In valuing the undertaking, he considered that the Company were entitled not only to the mere structural value of all the excess works already shown, but to the actual earning power of such works. He started with the amount required to pay the standard dividends (£811); and being absolutely certain of the security, he allowed 28½ years' purchase, which produced £23,113, or, *plus* the usual 10 per cent. (£2311) for compulsory purchase, £25,424. To arrive at the earning value of the surplus works, he assumed that the rate of increase would be 6 per cent. per annum, the same as it had been for the past three years; so that the full productive power of the works would be reached in about five years' time. He calculated, on this basis, that the £811 would have increased in the five years to £1085, or an addition of £274. The present value of this sum on the 3 per cent. table was £236. This he capitalized at the same rate as before—viz., 28½ years' purchase—producing £6726, or, with the £25,424, £32,150, his final figure. These sums all dealt with the concern as in the year 1899; the capital expenditure since then (amounting to £977) should be repaid the Company by the Corporation in addition.

In cross-examination, witness said his valuation of the land worked out to over £1000 an acre. He did not know that land adjacent was recently sold for £300 an acre. One reason for his high valuation was that there was no other land in the district in regard to which there were parliamentary powers for the manufacture of gas. He reckoned six weeks' coal-storage was ample. At Brighton, they had about three months' storage; but there were special reasons for this. The retorts would supply 5000 cubic feet per mouthpiece, day in and day out; and with slight alteration, they could produce even more. He did not agree that they could make only 4000 cubic feet per mouthpiece. Witness was cross-examined at some length as to the dimensions and capacity of various parts of the works; but he maintained his attitude as to the portions in excess, and their capacity. The pressure usually was 35-10ths, but the holder used for the supply of Street was capable of giving 41-10ths. His figure (25) of the percentage of coke which should be used, was 5 per cent. less than that of Mr. Newbigging. At Brighton, the figure was 19 per cent.; that was using a different coal, but with direct firing, and no regenerators. If he could put in regenerators at Brighton, he would reduce the figure to 12½ or 15 per cent. Asked to break up his figure of 6d. for maintenance and renewal of works, mains, services, meters, and stoves, witness allocated 3d. to the works, 2d. to the mains and services, and 1d. to the meters and stoves. This would be 5d. for mains and services. In Brighton, it would be more; but there were special charges there owing to the introduction of the electric light.

Re-examined: The large coal storage at Brighton was due to the fact that there was no direct railway communication with the North; so that they had to depend entirely on ships, which were often delayed in coming into the harbour, owing to the formation of a bar across the entrance.

This closed the case for the Company; and evidence for the Corporation was then called.

Mr. *George Alves*, Borough Surveyor for Glastonbury, said the allowance of £1200 an acre for the site of the gas-works was altogether exorbitant. For land closely adjacent to the works, on which the new market was built, £300 an acre was paid.

Mr. BALFOUR BROWNE objected to his giving the figure which was paid for the adjoining land; but witness blurted out the answer before he could be stopped.

In cross-examination, witness said he had not had any experience of the value of land in regard to which there was a right to manufacture and sell gas.

Mr. *E. H. Stevenson* said generally the works were in good order, and substantially built, though he considered the holders were a bit light. In 1899, the maximum daily make was 71,000 cubic feet. He had been prepared to allow excess in respect of things which Mr. Newbigging did not claim; and therefore, when he handed in his valuation, it would be seen that he had struck out things which Mr. Newbigging did not claim, and which he (witness) had been prepared to grant. For excess coal-storage, witness allowed £150, and thought he had been exceedingly generous, because he could have fairly claimed nine weeks' storage in a place like Glastonbury, with only a single line of railway. Two of the coal-sheds had only a roof and a big wall; the other two had three walls and a roof. None were closed in. In respect of the retort-house and stack, he allowed £300 on account of the retorts and £250 for the retort-house—£550 in all. As to the retorts, he said he never dealt with things theoretically, but always as he found them; and he found that these retorts did not make 4000 cubic feet per mouthpiece on the average of a week. The highest they had ever made was 4400 feet on one day. The coal was not North Country coal, which could be worked off quickly, but heavy coal, which would lie in the retorts a long while. The books showed that, for the week ending Oct. 19, the make was 3997 cubic feet per mouthpiece. Then they lighted up a further bed of four retorts; and, in the week ending Nov. 16, they made an average of only 3406 cubic feet per mouthpiece. So that the effect on the average of the lighting up of the additional bed was that, whereas the average of eighteen was nearly 4000 cubic feet each, the average of twenty-two was only 3406 feet each. This was a certain sign of the poor firing and setting of the retorts—indeed, they carried him back to the kind he used to see 25 years ago. When the Corporation had the works, they would at once have to start using the eighteen retorts; and then they must have one bed of five as a stand-by, so that there would be but twelve old and poor retorts as excess. The condenser had only an external area of 467 square feet, with a capacity of 67,000 cubic feet. The pipe was much too warm when he was there. He took it to be just about equal to the requirements of 1899; and he therefore allowed nothing for it. As regarded the exhauster, it was necessary and desirable, as Mr. Cash admitted, to have a second; and the scrubber (also admitted to be deficient) would have to be altered. There were only three purifiers; and they were such that it was utterly impossible with them to telescope the present gasholders, as had been stated could be done. He allowed £40 for them. He should not have allowed anything for excess works if the Company had been paying their standard dividends, because he did not think Parliament intended them to have anything beyond the capitalized value of the full profit income properly secured. The meter was equal to 8000 cubic feet an hour; and for its excess capacity he allowed £80, which was a liberal figure. He was at present putting in a 10,000 cubic feet meter on last year's prices—which were the highest known—and it was costing only £190. Therefore, to allow £220 as the value of an 8000 cubic feet meter forty years old, was obviously too much. It was absolutely inaccurate to call it a 10,000 cubic feet meter, although it might be forced up to even 12,000 or 18,000 feet. As to the gasholders, he allowed £630 (against Mr. Cash's £680), taking the excess at 21,000 cubic feet, and the cost at £30 per 1000 feet. He allowed nothing for land, because he did not think there was more than was useful on any works. To say that the works were too big, and then to claim for land on the ground that buildings could be put on it seemed inconsistent. There was absolutely no room to build anything more, except perhaps another gasholder, and this would have to be a small one. The making of a siding at the works could only be done by blocking up the yard way, besides which the yard was on a sharp incline. Summarizing his allowances and claims in respect of works, he said he allowed £550 for retorts and retort-house, £150 for coal-store, £80 for meter, and £630 for gasholder—a total of £1410. But from this there was to be deducted £60 in respect of the scrubber deficiency, and £120 for a duplicate exhauster, a total of £180—leaving £1230 net. In his valuation, he started with £572 11s. 11d., the profit for the year 1899, as shown by the tables. Then he held that anything which would vary the accounts of 1899 up to the date of the notice to treat, ought to be taken into consideration. His first deductions were £11 11s. for depreciation on stoves, and £8 2s. 6d. for discount on gas to the Lock Hill Company—leaving £552 18s. 5d. Then he made an addition in respect of the excess charge for repairs and renewals of works and mains, at the rate of 1·47d. per 1000 cubic feet, which, on 13,464,000 feet, made £82 10s. He agreed with Mr. Cash as to the figure of 5d. The difference between him and Mr. Cash was that Mr. Cash added something for meters and stoves, which witness held should not be done. The proportion of meters or stoves owned by a gas undertaking and its consumers varied considerably. Therefore these things must be considered according to each particular place. Turning for the moment to the decrease in profit during the last three years, witness said the whole of this decrease had been due to the extra charge for repairs and maintenance. But for this charge, the profit for these years would have been practically the same. As regarded coke, Mr. Newbigging allowed £138, and Mr. Cash £158; but witness only allowed £60 5s. 4d. Witness, in place of the 56·6 per cent. consumed, estimated the proper amount at 45 per cent. The quantity of coke used as fuel, as shown by the carbonizing returns for the first nine months of 1900, when chiefly (almost entirely) the new retorts were used, was 38·6 per cent.; but if they had employed partly the new and partly the old retorts, the percentage would have been 45. In 1897, the coke consumption was much greater than in 1899; the coal used by the Company was not a good coking coal—not nearly so good as coal purchased from the North Country. Adding these two items of £82 10s. and £60 5s. 4d. to the £552 18s. 5d., made £695 13s. 9d. With regard to the averaging of the stationery, printing, law charges, &c., he said he never touched these things. If, as was done on the other side, one thing was averaged, there was no reason why everything should not be. The practice of averaging had never been adopted before so far as he knew. There were two deductions which he made, and which the other side had not touched. In arriving at the figure of £572, gas was taken at 4s. 6d. per 1000 cubic feet, less 3d. discount; but the price at the time of the notice to treat was 4s. net. So that, off the £572, 3d. per 1000 cubic feet should be taken. He had never known a company claim a higher price than the selling rate at the date of the notice to treat. This, on the gas consumed during the nine months commencing Jan. 1, 1900 (10,051,000 cubic feet) equalled £125 12s. 9d. Then he held something must come off in respect of the probable average permanent increase in the net cost of coal spread over the next 25 years, which he put at 1d. per 1000 cubic feet, and which made £56 12s., and, with the other deduction, left £513 9s. There was not the least doubt that, as against 1899, there would be, on the average of the next considerable number of years, an increase in the net cost of coal It was common knowledge that it was so after 1873; and it was only likely that it would be so again. In his judgment, 1d. per 1000 cubic feet was not too much to allow for this. Deducting, further, the mortgage interest, £88, left £425 9s., which, at 28½ years' purchase, made £12,155. He allowed this number of years' purchase because he considered the £425 9s., which he brought out as the maintainable profit, as thoroughly well secured. There was yet another deduction—viz., the loss on gas consumed by Messrs. C. & J. Clarke in 1900, 1,367,000 cubic feet at 3·92d. per 1000 feet, which worked out to £22 6s. 6d., or, for the 8½ years the contract had to run, £189 15s.; leaving £11,965 5s. He calculated that the cost of gas was 35·92d. per 1000 cubic feet; and as Clarkes were paying only 32d., there was a loss of 3·92d. per 1000 feet. He had no doubt that, if there was a loss on this contract, the Company, not the Corporation, must be the losers. Then there was the profit on the fittings, £24 4s. 5d. He should have put this at five years' purchase; but as the Company had taken it at three years, he left it at that, which produced £72 13s. 3d. This, together with the £1230, his estimate of the structural valuation of the excess works, made his final figure of £13,267 18s. 3d. With reference to the earning value of the excess works, it had been claimed before, but not, he thought, given. It had never been claimed in an undertaking of this description, and never in addition to the dividends a company could pay at the price of gas the Company were charging. If the Company claimed their standard rate of dividend, and that had been maintained, he should certainly not have added anything for excess works; he should simply have considered such works as security.

Mr. BALFOUR BROWNE (in cross-examination): Is it not a little mean to accept every figure of ours when it is in your favour, and reject every figure when it is against us?

*Witness:* No.

Your view was that we should have five years for the fittings; and simply because we have only claimed three, you have altered that?—Well, I always think people know their own business best; and if you consider that the profit on fittings is so insecure, I suppose you know better than I do.

Now as to the excess, do you know that the Company spent £1230 in 1899?—Yes.

And for that we have got no benefit in revenue in the accounts of 1899?—Well, the greater part of the expenditure was for the 6-inch and the 8-inch mains. There is no doubt that the 6-inch main was absolutely necessary, and the extra gas which you have sold since then has necessitated the taking up of that 6-inch main.

Cross-examination continued: If the money were spent, and no advantage was obtained by the Company, it did not look as if there were excess, because previously the Company could not have been supplying Street properly. It was necessary to lay a larger main. This main was laid and more consumers were obtained; and then the pressure sank in times of greatest draught from 37-10ths to 8-10ths. The scrubber was deficient; but the washer was sufficient for tar extraction, though not for ammonia. He did not agree that Somersetshire coal gave more gas than Durham coal. He did not care for analyses of coal; working was the thing to test it. There was no room for another bench of retorts in the retort-house. If a company were paying full dividends, and had double or treble the works necessary, he should allow nothing for the excess; they would only bear on the security of the income. At the end of the year of account, the Company made alterations which put them under different conditions of working; and these alterations had to be considered in making the valuation. The Company reduced the price of gas from Jan. 1, 1900; and this ought to be reckoned against them.

Mr. BALFOUR BROWNE: If you are going to do that, why am I not to be allowed to introduce my increase of 28 per cent. in 1900 sales?

*Witness:* I do not see any reason why you should. You have altered the profit on that year as against us by reducing the price of gas and keeping it at that until after the notice to treat.

I have also increased the consumption by 28 per cent.?—I suppose your witnesses and your Solicitor know how best to present their case through you.

You have here reduced by £122 19s. 6d. our profit in the year, upon a consumption 28 per cent. less than in 1900?—I say that you reduced the price of gas upon us. We gave you notice with the price of gas at 4s. per 1000 cubic feet.

Further, are you not assuming that this loss is going to be an absolute permanent loss?—No.

You multiply it by 28½ to get it in perpetuity?—Certainly, a loss like that, where you reduce the price upon us.

You are assuming that this £122 is going to be lost in perpetuity?—So it would be if we reduced any more, or if you raised it and reduced it again.

Do you know this advance was made at the request of the town of Glastonbury?—I know it was not.

Is it not a fact that, after the high prices of coal in 1874-5-6, it got back again to the normal price in 1879?—No.

You have assumed, in this calculation of £56 12s. against us, a permanent rise in coal?—On the average (that is, that on the average of years) there will be an increase in the net cost of coal. I do not think there is any doubt in the mind of anybody that it will be so.

I do not see anything for compulsory sale?—No; If the Umpire thinks it should be put on, he will do so. I am not going to offer it.

Mr. *Austin*, the Town Clerk of Glastonbury, in reply to questions, informally stated that he had no knowledge of any request on the part of the Corporation for an alteration in the price of gas.

Mr. *W. R. Chester* handed in a valuation which, in the main, agreed with that of Mr. Stevenson. He allowed £1270 for excess capacity in the works—made up of £540 for retort power, £100 for station-meter,

and £630 for gasholder. No other portion of the works, in his judgment, was in excess. He deducted nothing for an additional exhauster (the present one being slightly in excess of requirements), or for the additional scrubber. He agreed with Mr. Stevenson that the over-expenditure on wear and tear should be confined to works, mains, and services, excluding meters and stoves. Meters and stoves were practically never included in the cost of wear and tear, because they were figures varying as the seller of gas was or was not the owner of the stove or meter. Witness also thought the figure of fuel consumption should be 45 per cent., the same as Mr. Stevenson. He, however, allowed a good deal more for the probable increase in the price of coal than did Mr. Stevenson. There had already been a considerable increase between the account year and the year ensuing, amounting to from 5s. to 8s. per ton. In witness's opinion, it would be quite impossible for prices ever to return to the minimum existing prior to 1889, because there was not now the same opportunity of increasing the output as there was in 1874 and 1875. Many of the collieries then started were now on the point of being worked out; and in his opinion there would be an increase in the price of coal which would be permanent. It would not revert to the lowest figures of former years. He assumed that this increase over the normal would be at least 1s. 6d. a ton for the future, and that there would be a rise of 1s. 6d. a ton in the value of coke, or a net increase of 1s. a ton on coal, which, on the 1602 tons carbonized, represented £80 2s., against Mr. Stevenson's figure of £56 12s., which about represented the difference between witness's figure of maintainable profit (£400) and Mr. Stevenson's (£425). This figure witness capitalized on the 3½ per cent. table, 28·57 years' purchase, and added three years' purchase of the profit on fittings, together with his estimate of the value of the excess works, and thus brought out his final total of £12,861, to which was to be added the costs of the arbitration, the Company's parliamentary costs £625, and £200 towards the cost of winding-up, as well as the stock-in-trade and stores.

## Saturday, Jan. 19.

Mr. *Chester*, in cross-examination by Mr. GOULD (in the temporary absence of Mr. Balfour Browne), said he claimed 1s. 6d. per ton for the permanent increase in the price of coal. This was an assumption arrived at by evidence of what was going on all over the country. He made no allowance at all for a growth of business, and consequent growth of profits.

Mr. GOULD: I put it to you that your increase in the price of coal is an assumption founded on opinion. The growth of the Company is also an assumption; but it is an assumption largely borne out by what has taken place in 1900?

*Witness:* Yes.

You make a deduction from our revenue in respect of the 3d. per 1000 cubic feet by which we reduced the price of gas?—Yes.

We were selling gas in 1899 at 4s. 3d.; and you deduct for that 3d. because we lowered the rate. Why should we not be equally entitled to add to the revenue in 1899 the 3d. which we had in hand?—Because we can only argue from what you did, not from what you might have done.

Mr. GOULD: You say we can only argue from what we did. Well, we raised it again.

Mr. WEDDERBURN: That was in 1900, after the date of the notice to treat.

Mr. GOULD: Mr. Stevenson claims for loss on Clarkes' contract, whereas you do not?

*Witness:* No; it is too small a thing.

Mr. VALON: You have allowed something in your valuation for a permanent rise in coal. Is there not a margin between what the Company are charging and their maximum charge to allow for this?

*Witness:* Yes; but they are not charging the maximum.

The margin for coal you put on in your valuation is more than covered by the margin the Company have between the maximum price and the selling price?—Yes; I believe that is so.

Supposing you were right in deducting 3d., should we not be right also in adding an imaginary 3d. to bring up our income?—No, because the 3d. reduction is a fact; the increase is a matter of imagination.

You agree, anyhow, that the margin of the Company's maximum would give enough to cover any loss in coal?—I think it would

This closed the evidence.

Mr. WEDDERBURN, in addressing the Court for the Corporation, said but for the words in sub-section 2 of section 5, this would be simply an ordinary case of valuation. The question would be: What is the maintainable revenue, how is that revenue secured, and, therefore, what is the proper number of years' purchase to allow? But here there was something special—namely, the words "in the event of such arbitration taking place, the arbitrators and umpire shall, in settling the amount of compensation to be paid by the Corporation to the Company, have regard to, and make allowance"—it did not say in favour of whom—"for, the capacity of the works and plant being in excess of the requirements of the Company and sufficient to meet future requirements." It was not right to say that this clause persuaded the Company to withdraw from their opposition in Parliament. The question was what the words meant. It seemed to him that the meaning was perfectly clear—namely, that if there were works or plant on the premises of the Company which would save the Corporation future expenditure, the latter were to pay a sum for it now, that sum being discounted; also that if there was an excess which could never be any good to the Corporation at all, or only so many years hence that the Court need not take it into consideration, then the Corporation were not to pay anything for the excess. It could not therefore be said that the clause was altogether one-sided; it worked both ways. If the Corporation had shown that there were a lot of useless excess works, they would have said also that for such excess the Company were not to be paid. But the Company had shown, and the Corporation admitted, that there were certain excess works; and for these works clearly the Corporation were to pay—the sum being discounted according to the time at which they would become useful. As he interpreted the Act, they could only consider excess in works and plant; the Court could not consider land at all. That evidently was also the opinion of Mr. Newbigging, for he commenced his valuation with structural valuation of surplus works and plant and including land, which clearly showed that "works and plant" (the words of the Act) did not include land, because otherwise the three words "and including land" would be surplussage. Works and plant never did include land, and could not possibly do so; they were something on the land, not the land itself. It was absurd to claim at once for excess works and excess land. One could not claim, at the same time, both that the works were too big and then too small, so that the excess works would be of value. If the works were too big, the excess land would be useless. Excess land could only exist and be of value if the works were too small, and more land was required to build more works on. The moment the Company admitted they had got more works than they wanted for many years to come, it could not be said that they wanted more land. At the beginning the section in question ran "In, and for the purposes of, this Act, the expression 'the undertaking of the Company' includes all the gas-works, engines, mains, pipes and machinery, lands and buildings, plant, and other property," &c. So that where they wanted to include lands, they actually put the word "lands in;" but where they did not want to put it in, they had the words expressly limited to the capacity of the works and plant. Further, the section said: "The Company shall sell and transfer to the Corporation, and the Corporation shall purchase, the undertaking of the Company;" and if an arbitration took place, what was to be considered in excess was not the undertaking (which earlier in the section had been defined to include lands), but the works and plant. That, he submitted, entirely disposed of any attempt to claim for land in addition to works and plant. With regard to the claim for £7999, the earning value of the excess works, as an alternative to £2818, their structural value, made by Mr. Newbigging, Counsel said that it struck everyone as an afterthought. The larger figure was not on any sheet put before the Court; and it was only at the close of his evidence that he made a sort of suggestion that he might do away with his evidence as to structural value, and claim earning value. The question of the earning value was very speculative; for Mr. Newbigging and Mr. Cash set up a sort of ideal, instead of basing their figures, as Mr. Stevenson did, upon the practical working. The earning value depended entirely on the circumstances. Excess works might be one thing; increasing demand was another. What could be more unfair than to take the earning value? The Corporation bought the concern now. After purchase, they could build these works. Why, because they bought the works, should the Corporation be placed in the position, simply because somebody else built them, of having to pay about four times what they could be built for? Further, the Corporation would have to forego whatever profits they could make if they themselves could build these works. This seemed altogether unreasonable. Counsel proceeded to criticize the various items of the valuations in detail. He said it was not fair to treat all margin as excess, because beyond the reasonable requirements they must have something to spare which they might not be using; and then what was beyond this would be excess. As to the retorts, Mr. Newbigging allowed £1124, Mr. Cash £1400, and the Corporation witnesses £550. Here neither Mr. Newbigging nor Mr. Cash would condescend to be practical. There were three sets of six; and it was admitted that, while these might be made to produce more than 71,000 cubic feet daily (the maximum day's make); yet to produce this amount they could not do less than light up all the retorts. Mr. Cash also admitted that it would be a fair thing to have a set of five as a stand-by. It followed, therefore, that the excess was only twelve retorts—one set of three, one set of four, and one set of five. If this was so, how could Mr. Newbigging or Mr. Cash either sustain his figures—especially as the retorts were of ancient type and poor power of production? He had already dealt with the claim for land. It seemed clear it was not included in the Act. But if it were, he should submit that there was none in excess; that if there was any in excess it would be useless for many years, because telescoping the present holders would answer every purpose; and that both Mr. Newbigging and Mr. Cash had attributed to it a ridiculous value. Excess works only affected the security, and could only be allowed for where a company were not earning their maximum dividends; when once they assumed the payment of maximum dividends, with perfect security (which in this case was represented by 28½ years' purchase), there could be no such thing as excess. The Company all along had held that their maximum dividends were not absolutely secured. Mr. Newbigging commenced with the figure of £572, with which all agreed; and then he made adjustments, bringing out £795 as the maintainable profit—the highest amount the Company could possibly maintain. Then, he said the Company must take, not this figure, but £811, the figure they would like it to be, which would enable them to pay full dividends. And although he admitted that this was not perfectly secured—for £795 was not £811—yet he claimed as if the standard dividend was absolutely secured, which was obviously wrong. Starting with the £572, what additions and subtractions had to be made? The Company approached the matter of coal as idealists. In all undertakings there might be a bad servant, as with this Company. The right way was to take what a reasonable manager would do; and if bad management was to be introduced, it should be brought in as a factor which might affect the Corporation, just as it had affected the Company. What was the fair percentage of coke to use? Mr. Newbigging put it at 30, Mr. Cash at 25, and Mr. Stevenson and Mr. Chester at 45. In arriving at the right figure, they had to consider that some of the retorts were new, some old, and that retorts and settings were small. The actual figures for the first nine months of 1900 showed that neither 30 nor 45 was the ruling percentage. Using only the new retorts in that period, the ruling figure was 38·6 per cent., which showed that 45 was much more nearly justified as an average of old as well as new retorts than 25 or 30. As to the question of depreciation of meters and stoves, the Corporation held that the item could not be included, because no average was obtainable. Even Field could give no average, because in some cases these appliances were in possession of the Company and in others they were in possession of the consumers. Regarding the adjustment in respect of the alteration in the price of gas, all the Corporation asked was what, as he understood it, was the practice in these matters—viz., that they should look at the condition of things at the time of the notice to treat. Although in 1899 they had been charging, in effect, 4s. 3d. per 1000 cubic feet to the ordinary customers, at the beginning of 1900 they reduced the price to 4s.; and this was

the ruling charge at the date of the notice to treat. It was therefore the price to be considered; and so a deduction should be made for it.

The UMPIRE thought it was stated that the price was raised again.

Mr. WEDDERBURN said that was so, but after the date of the notice to treat, so that it could not be noticed. Then there was the probability of an increase in the price of coal. That was a matter about which the Court would probably know more than he did. Both Mr. Stevenson and Mr. Chester said there would be an increase on the average; and if that were so, something should be allowed. He submitted broadly, in conclusion, that the net maintainable revenue was about the figure of Mr. Stevenson £425; and believing this income to be well secured, he agreed that it should be capitalized at 28½ years' purchase, besides which there were one or two other items, including the 10 per cent. for the sale being compulsory, which it was customary, he believed, in the discretion of the Court to allow.

Mr. BALFOUR BROWNE, in replying on behalf of the Company, said there were many points on which he could not help the Court at all. The Court were perfectly competent to state in their award what, in their view, the excess plant amounted to. They had practically an agreed figure of the maximum make for 1899, and they had the dimensions of all the works; and it would be wasting time to go over the evidence on these points. There could not be a greater fallacy, however, than to say the Company were entitled to nothing for land. He claimed for land just as he claimed for things on the land. If land was not included, what was the meaning of saying the things planted on the earth were included? It was perfectly obvious everything called works was to be considered; and gas-works, in the ordinary sense of the word, meant everything within the walls. As a fact, they had not to ascertain whether there was excess, but only the extent of the excess, because the Act declared that there was excess. The Act defined "the undertaking of the Company" to include "gas-works, engines, mains, pipes and machinery," and "land;" and no man ever yet said that land, the yard, for instance, was not part of a gas-works. Then the Act said: "In the event of such arbitration taking place, the arbitrators and umpire shall, in settling the amount of compensation to be paid by the Corporation to the Company, have regard to, and make allowance for, the capacity of the works and plant being in excess." Mr. Wedderburn said it did not state to whom the allowance was to be made; but it did. It was in settling the amount of compensation to be paid by the Corporation to the Company. He also said the words did not include excess land, which was mentioned higher up. He might just as reasonably exclude pipes, machinery, and mains as land. The Court had to look at the total capacity of the works; and if there was any in excess, allow for it its earning value. The ordinary way of valuing a concern was to find out the maintainable revenue; and if it was well-secured, capitalize it at 28½ years' purchase. But suppose in the account year a gasholder was erected, but was not used at all, being necessary for future wants? How would the vendor be paid for that? Mr. Wedderburn said that if the Company were below their maximum dividends the Company would be paid for that; but if they were earning their maximum dividends, they would not. But he forgot that this was not a maximum dividend Company at all. The fallacy of Mr. Stevenson was that a lowering of the price of gas of 3d. necessarily meant a loss of revenue. It meant an increase of the amount the Company could divide. By reducing the price 3d., the Company could divide ¾ per cent. more; and if they could earn sufficient, and reduce the price sufficiently, they could divide 15 or even 30 per cent. Therefore the argument could not be sustained. In an ordinary case, the witnesses ascertained what works were necessary to earn the dividend, and then made an allowance, as the works were in excess or deficit. But the section here was not the ordinary section. Under it the Court were directed to "have regard to, and make allowance for," not the structural value of the works, but "the capacity of the works and plant being in excess" of the present requirements of the Company. The word "capacity" pointed to earning power; and the only way the earning power could be ascertained was by calculating it as Mr. Cash and Mr. Newbigging had done, and discounting it back to present value. They had calculated on a very small increase of 6 per cent. for every year, whereas they knew that, in the first year, the increase was 26 per cent. So that these witnesses had discounted it too much. In these circumstances, he claimed that they must value the structure—the plant earning the revenue, and the plant capable of earning the revenue—on precisely the same basis. He briefly referred to Mr. Stevenson's "mean" action in eliminating from his valuation items which he had been prepared to allow for, merely because the Company's witnesses had not claimed for them, and went on to characterize his valuation as fantastic. It was proved, and not challenged, that the structural value of the works was over £18,000; yet Mr. Stevenson brought out the total value of the undertaking as £13,000, or about two-thirds of the structural value of the works—which was absolutely fantastic. Again his figure of the revenue derived from the sale of gas (some £400) worked out at less than 2¼ per cent. upon a structural value that was not questioned. One fallacy of Mr. Wedderburn was in asserting that his witnesses allowed 28½ years' purchase because they made the maintainable profit the small figure of £425; and he added that if the maintainable profit had been £811, it would not be right to give 28½ years' purchase. This was an absolute fallacy, because it did not matter whether the figure was £400 or £8000; the simple question was whether it was well secured. If £811 was secured, £425 was no doubt better secured—but only by depriving the Company of the value of the difference between £811 and £425. The principle of the Company's case was admitted; for the Corporation agreed that £572 11s. did not represent all that might fairly have been earned by the undertaking in the year. With regard to the bad management, the Court had to decide what was the earning value of the instrument—not of a mismanaged instrument. Bad management was not disputed, because the Corporation agreed that the Company ought to have made £60 more out of coke. The whole question was how much more they ought to have made. Again, the two sides were agreed in principle, as to the deduction for repairs and maintenance. For these items Mr. Stevenson allowed £142, and then wiped off considerably more—£179. Counsel, however, urged the Court to ignore altogether the deduction in respect of the reduction of 3d. in the price of gas from Jan. 1, 1900, because it had been agreed that they had nothing to do with the year 1900. If they were to have anything to do with 1900, they must take all the figures. If they reduced the price by 3d., they should allow for the increased revenue of over 20 per cent. which occurred in that year. A second large deduction was made in respect to the average increase in the price of coal which it was alleged would take place in the future. But the worst was now past; and it was agreed that coal was going down, and was down now by about 4s. Was coal going to rule higher for all time? Because coal went up one year, it did not follow that it would remain up. He therefore urged that nothing should be allowed for either of these items. The other side had included nothing for the sale being compulsory. He urged the Court to allow the usual percentage; for undoubtedly the sale was compulsory. In conclusion, he asked the Court to come to a decision as to the excess plant very much on the basis of what they themselves would see when they visited the works; to say that the deductions made by Mr. Stevenson were entirely wrong; and to find that the allowances Mr. Stevenson had made were right in principle, though too low in amount. If they did this, they would allow practically what the Company's witnesses sought.

The proceedings then terminated; the Umpire reserving his award.

## EDINBURGH AND LEITH GAS COMMISSION.

### Visit to the New Gas-Works at Granton.

After about a year-and-a-half of construction, the Edinburgh and Leith Gas Commissioners are about to derive revenue from the new gas-works they are erecting at Granton. This will not be from the manufacturing department—which, unfortunately, owing to delays in the completion of masonry and the forwarding of ironwork, will not be ready for use till the summer of 1902—but from the residual products works. These are now all but completed; and before bringing them into use, the Granton Sub-Committee, in conjunction with the Works Committee, invited the Commissioners to pay a visit of inspection to the new undertaking. When they arrived on the ground, the Commissioners found that since their visit on the 14th of May last great progress had been made. They first went to the retort-house, which they found so far advanced that, though there are yet several feet of side walls to be built, of the circular girder roof, springing from the charging-floor level (a diagram of which was given in the "JOURNAL" for Aug. 7 last, p. 350), nearly the whole has been erected. A description of the retort-house plant was given by Mr. W. R. Herring, the Gas Engineer, in his paper read before the North British Association of Gas Managers at Edinburgh in July last (published in the same issue), and it will be sufficient to say here that, under cover of the roof, a beginning has been made with the construction of the two benches which are to accommodate the inclined retorts. These are to number 504, placed in settings of nine. Each retort is to be capable of carbonizing about 2 tons of coal per day of 24 hours. The retort-house is 386 feet long and 100 feet wide inside. Mr. Herring described the working of the coal and carbonizing plant; explaining that, from the time it enters the works till it is discharged as coke, not a shovelful of coal will be moved by manual labour. In connection with the statement that the retort-house would be capable of producing about 10 million cubic feet of gas per day, Mr. Herring explained that the experimental setting of inclined retorts in the Edinburgh works was working so well that they would get 30 per cent. more gas out of the new building than they anticipated when the new works were planned. The Granton site, it was stated, had been laid out for seven such sections as the one in course of construction; and before they closed down the other works, it would be necessary to put up another section similar to this one, but they would only require to half fill the retort-house. To the west a coal-store has been erected, which will serve the retort-house now in progress and another on the western side of the store. The coal-store is a modest building, as regards height, when compared with the retort-house; but it covers a larger area, being 500 feet long and 100 feet wide. The greater length is explained chiefly by the fact that in the southern end of the building there will be placed the washing and scrubbing plant. The whole of the walls of this building have been erected, and the roof is being put on. The storage capacity will be 18,000 tons; the intention being to store only the softer kinds of coal inside, the harder varieties being stacked in the yard. There will be available, both inside and outside, storage to the extent of 35,000 tons, equal to about 35 days' present demand. In both houses the concrete floors are down; but the plant, the construction of which has been entrusted to Messrs. Graham, Morton, and Co., Limited, has not yet been more than started.

Some time ago, the Commissioners took the opinion of their workmen upon whether they would be willing to reside in the neighbourhood of the gas-works, in the event of dwelling-houses being erected for them. Only 18 per cent. of the men signified their assent; and the Commissioners have accordingly relinquished the idea of building, and have now resolved upon the erection of a passenger railway station within the works, which will land the men where they will only require to cross a bridge to reach the door of the retort-house. Having looked at the site of the station, the back wall of which, Mr. Herring explained, was built partly of stone from the old chimney in the Edinburgh works, the party walked northwards to the new gasholder, passing on the way huge piles of steelwork delivered for use in the erection of the retort-house and gasholder, the site of the purifier-house, which is being excavated, and the pumping station, the walls of which are being built. The gasholder tank is all but completed; the only work remaining to be done being the concreting of part of the floor. The workmen of the contractors for the holder (Messrs. Clayton, Son, and Co., Limited) are on the ground, and have fixed nearly all the channel-irons upon the wall of the tank. The gasholder will be of 6½ million cubic feet capacity—about equal to the existing storage in all the other gasholders belonging to the Commissioners. Its completion will thus double the storage, making it more than the present maximum daily consumption, and will remove one of the most serious difficulties connected with the existing gas supply.

From the holder, the party walked to the new chemical works—in the

north-west corner of the ground, about a quarter of a mile from the holder. Here constructional work has been completed, and the laying out of the ground is in progress. The handsome building, of red compressed brick, faced with stone, of which Mr. Herring was the architect, was greatly admired. In the grounds is a large cast-iron tank, which, notwithstanding that it was for about seventy years in use as the tank of a gasholder in the Portobello Gas-Works, and was for the whole of that period underground, is as good as new—showing only slight pitting of the surface. It has been erected alongside the railway siding, and will be used for storing crude liquor. There is also, outside, the plant for dealing with the noxious gases evolved in treating the liquor and for the recovery of sulphur, as well as the acid-tanks, placed apart, on high ground. Inside there is an air-compressing apparatus, driven by steam—the air to be used for pumping purposes, and for forcing the sulphate of ammonia from the saturator into the straining-tank; thus dispensing with manual labour, and allowing the whole process to be under cover and continuous. This apparatus was working on the occasion of the visit. The two stills are all but completed. It is intended to have the works running in about four weeks' time. The principal recoveries will be sulphate, muriate, and carbonate of ammonia. The production will be about 10 tons per day. Mr. Herring stated that in the process of working many foul gases are thrown off, and the works outside are intended for their destruction, They had been put up to the approval of the Inspector under the Alkali Acts, and he was confident that no nuisance would be created in the neighbourhood.

This concluded the inspection. The party then drove to Granton House, the residence of Mr. Herring, where they were received by Mrs. Herring. Refreshments were served, and one or two toasts were proposed. In the course of conversation, Mr. Herring mentioned that up to the present, speaking roughly, about £100,000 has been expended upon the new gas-works. He also explained that out of the weak liquor produced only 1 ton of sulphate is obtained from 25 tons of liquor; and that the gain to the Commissioners will be considerable if only the saving in railway carriage is taken into account—the difference being the conveyance of 25 tons to Falkirk and its conveyance to Granton.

## BURTON-ON-TRENT GAS SUPPLY.

### Development of the Gas Undertaking.

Application having been made to the Local Government Board by the Burton-on-Trent Corporation for authority to borrow £17,480 for the purpose, among other things, of extending their gas undertaking, an inquiry into the matter was held last Wednesday by Lieut.-Col. A. C. Smith, R.E., at the Town Hall. Among the officials in attendance was the Engineer and Manager of the gas and electricity works (Mr. F. L. Ramsden). The Town Clerk (Mr. T. N. Whitehead) explained that the population of the borough was about 52,500, the assessable value about £300,000, and the debts outstanding about £335,000. Of the total amount applied for, £4985 was intended for gas cooking-stoves, £10,984 for prepayment meters, and £1000 for workmen's mess and bath rooms. However, he wished the Inspector to reduce the last-named sum to £600, but another item would be raised with the permission of the Board. He then gave figures respecting the increase in the number of cooking-stoves, and said that 393 were let on hire in 1900; so that the estimate of 750 for three years was somewhat below the mark. With regard to prepayment meters, they commenced fixing them in workmen's dwellings in 1897. There had been 1545 fixed, and already £7484 had been expended in this way; being £3484 in excess of the amount sanctioned by the Board. Up to the present time, no less than 2062 slot meters had been put in; and they had been the means of extending the consumption of gas. For the twelve months ending in March last, the gas consumed amounted to 289,928,300 cubic feet, against 247,501,900 cubic feet in the year ending March, 1897—an increase of 42,426,400 cubic feet. Since the opening of the negotiations for the borrowing of the sum applied for, they had fixed 207 gas-stoves at a cost of £1364 17s. 10d., and 277 "slot" meters at a cost of £2086 1s. 8d. Before they obtained the sanction, the Corporation calculated that many more would have to be fixed. Consequently, the application would be subjected to some alteration, as they would want £17,480 *minus* £400, the modified cost of the workmen's mess and bath rooms, and £5000 for money spent and to be spent before the sanction could be received. Thus, altogether, the Corporation would ask for £22,080, so that they could start with a clean sheet. They would not, perhaps, borrow the whole amount at once, but they wished for permission to raise it. The Inspector explained that it would be necessary to forward an amended application. The Town Clerk added that the new plant would consist of condensers, store-tanks, pumps, &c. There was no opposition to the application.

**Dover Water Supply.**—The water undertaking of the Dover Corporation yielded in the last financial year a profit of £4337, which is equal to a rate of 6d. in the pound.

**Omagh Gas Bill to be Opposed.**—A conference of ratepayers of Omagh was held last Tuesday for the purpose of determining what steps should be taken to ensure the defeat of the Bill promoted by the Omagh Gas Company to obtain extended powers. A report by the Committee who have had the matter in hand having been read, Mr. Clements addressed the conference. He said that, whether they lit the town with gas or by electricity, the lighting should be in the hands of the local body. The gas-works were started in 1850, with a capital of £2110; while at present the value of the concern was £15,000. This showed that it had been a flourishing undertaking, and one which, if in the hands of the ratepayers, would doubly pay them. If the Commissioners fifty years ago had taken over the gas-works, they would at the present time be putting aside £1000 a year. They were paying some £400 a year to the Company for lighting the town; and for this sum they could borrow nearly £4000, and in twenty or thirty years the works would be their own. After some discussion, a resolution was passed approving of the action of the Council in opposition to the Bill, and strongly recommending the Company to withdraw the measure, in order to save themselves and the ratepayers the heavy expense which a contest between them would entail.

## DETAILS OF A GAS-PURCHASE ACCOUNT.

### An Instructive Statement.

At last week's Meeting of the Skipton District Council, the Clerk reported that, with the exception of four small accounts, estimated at £30, he had now the full account relating to the cost of the purchase of the gas-works; and these he read as follows: Purchase money of the undertaking, £66,500; mortgage debt of £4750 created by the Gas Company, and directed by the award to be paid by the Council—a total of £71,250. The cost of the parliamentary proceedings (as taxed) were £2750 8s. 6d., made up as follows: Engineers' charges, £488 16s. 5d.; Accountants' charges, £106 6s. 4d.; Parliamentary Agents' charges, £344 1s. 7d.; Parliamentary Agents' payments out of pocket, £998 11s. 1d.: Solicitors' charges, £574 5s. 3d.; and Solicitors' payments out of pocket, £238 7s. 10d. The cost of the arbitration proceedings on both sides amounted to £2624 3s. 4d., made up as follows: Taxed accounts—Engineers, £405 19s. 6d.; Accountants, £116 11s. 2d.; London Agents, £385 18s. 6d.; Solicitor's charges, £146 0s. 10d.; Solicitor's payments out of pocket, £191 12s. 7d.; Gas Company's charges and expenses, £815 15s. 9d.; not taxed—Umpire's and Arbitrators' charges and expenses, £562 5s. The stamp duty on the conveyance of the gas undertaking amounted to £356 5s.; and further payments yet to be made, estimated at £30, made a grand total of £77,010 16s. 10d. Mr. Hargraves: For a £25,000 undertaking. Mr. Smith: No! Mr. Hargraves: That was our first offer. Mr. Smith: But the Company have expended nearly £20,000 since then. Mr. Thornton: £15,000. There the matter dropped.

## METROPOLIS GAS SUPPLY.

### Dr. A. W. Williamson's Quarterly Report.

The following is an extract from the report of Dr. A. W. Williamson, the Chief Gas Examiner for the Metropolis, on the quality of the gas supplied in the quarter ended the 31st ult.

I. *Illuminating Power*.—The average illuminating power in standard sperm candles was above the Parliamentary standard of the gas made by the Gaslight and Coke, Commercial, and South Metropolitan Gas Companies, at all the testing-stations. The minimum lighting power of the gas was above the requirements (16 candles) at the Kinghorn Street, Ladbroke Grove, Vincent Terrace, Graham Road, and Vinery Villas stations of the Gaslight and Coke Company, and the Wellclose Square station of the Commercial Gas Company. Deficiencies in illuminating power were reported by the Official Gas Examiners during the quarter at Fenchurch Street, Tudor Street, Spring Gardens, and Parnell Road.

II. *Purity*.—Sulphuretted hydrogen was not reported to have been present in the gas on any occasion. The average amount of sulphur in other forms than this was considerably less than the quantity permitted at all the testing-stations of the three Companies. Excesses of sulphur were reported in the gas tested at the Bedford Road and Blackfriars Road stations of the South Metropolitan Gas Company. Ammonia was present in the gas more or less frequently, but only in slight quantities. The amount allowed was not exceeded on any occasion.

## THE PRICE OF GAS NORTH OF THE THAMES.

### Agitation by Consumers and Local Authorities.

Judging by the number of items on the *agenda* for the Court of Common Council last Thursday, dealing with the price charged by the Gaslight and Coke Company, the coming session promises to be one which will not be barren of excitement, for not only are the Wardmotes of the City appealing to the Court, but nearly the whole of the newly-formed Borough Councils are approaching that body, and asking its assistance to obtain for them some measure of relief from the high charge of the above-named Company in their northern area, as compared with the low price paid by their consumers on the Surrey side of the Thames. The first item on the paper was a resolution from the Wardmote of Cripplegate Without, protesting against what was termed the "exorbitant price" charged by the Company on the north side of the Thames, against that of the South Metropolitan Company, and asking the Corporation to use their best endeavours to obtain a reduction. The resolution was at once unanimously referred to the Streets Committee, with instructions to take action upon it. Following this came a letter from the Ward Clerk of Farringdon Without, forwarding a copy of a report of the Ward Committee containing a recommendation on the subject of the charges of the Gaslight and Coke Company; and it was sent to the same Committee. Letters bearing on the question were then read from the Town Clerks of the boroughs of Finsbury and Fulham, asking the Corporation to support any action taken with the view to protecting the interests of small gas consumers north of the Thames. These letters evidently referred to the agitation which has been going on among the occupiers of the Peabody Buildings north of the Thames, who, as our readers are aware, have for some time been pressing for a reduction in the price charged for automatic meters and fittings; the tenants having received strong support from the borough of Finsbury and its member, Mr. H. C. Richards, Q.C. These letters were likewise referred to the Streets Committee, as was also a memorial received from the borough of Poplar. Subsequently a resolution was read from the borough of Shoreditch, asking the Corporation and the London County Council to take active steps to protect London gas consumers in the direction indicated at the recent conferences, and to oppose the granting of further powers by Parliament to the Gas Companies unless such relief were given. Whereupon Mr. Matthew Wallace, J.P. (Mayor of Camberwell), moved that the resolution be referred to the County Purposes Committee, as they dealt with gas questions. Mr. A. C. Morton, however, persisted that all resolutions

like this should go to the Streets Committee, as this Committee had successfully arranged, and carried through, the conference at the Guildhall with the Vestries and other local bodies, and these letters and resolutions were the outcome of that conference. Mr. Morton was successful in carrying his point; and the resolution was sent to the Streets Committee, as were also two letters from the boroughs of Paddington and Hammersmith, approving the resolutions passed at the recent conferences of Local Authorities on London Gas Supply. As Sir John Aird, Bart., M.P., the Mayor of the former borough, is on the Board of the Gaslight and Coke Company, the action of the borough will place him in a rather awkward position when the Company's Bill for additional capital is being considered. After the resolutions had been disposed of, Sir Prior Goldney, the City Remembrancer, presented his report on Bills deposited for next session—among them being those of the Gaslight and Coke and South Metropolitan Gas Companies, particulars of which have already appeared in the "JOURNAL"—and it was referred to the same Committee for consideration and report.

## WALSALL TOWN COUNCIL AND THE GAS UNDERTAKING.

### Expenditure on New Works—The Mond Scheme.

Two matters of considerable importance came before the Walsall Town Council yesterday week. The first had reference to expenditure in connection with the works improvement scheme which the Engineer (Mr. B. W. Smith) is carrying out, and the second was the consideration of the attitude the Council should adopt regarding the Mond scheme.

Approval was moved by Mr. Brownhill to the recommendation of the Gas Committee that eight new purifiers with revivifying-floor and conveyor should be provided at the gas-works, at an estimated cost of £10,500; that new workshops, stores, and other buildings be erected, at an estimated cost of £1500; and that a new condenser, exhauster, station meter, and governor be provided, the meter-house extended, and a main laid from the works, at a cost estimated at £4000. Mr. Powell complained of the Council being asked to sanction the outlay of so large a sum without explanation. Walsall, he said, had lost the position it once held of supplying cheaper gas than any other town in the country, and at the same time putting a large sum of money to relieve the rates. Other members also asked for further information. Mr. Brownhill, in reply, said the Council had previously authorized the expenditure of £21,000 for new gas-making plant, and they were now asked to expend £15,000 for additional plant. When these improvements had been carried out, the works would not only be up to date, but 30 per cent. larger than the present manufacturing capacity; and the Committee would be able to make a million cubic feet more gas per day. During the present winter, the demand for gas in one month increased as much as 17 per cent. compared with the corresponding month a year ago. There was clearly a great necessity for the plant being enlarged; and recently the works had only met the demand under high pressure. The resolution was then agreed to *nem. con.*

On a further recommendation, it was decided to accept the tender of Mr. T. Vale, of Stourport, for the reconstruction of one of the retort-houses at the works, for £2877; that of Messrs. J. M. Butt and Co., of Gloucester, for supplying and fitting the ironwork required to be used, for £2463 7s. 3d.; that of West's Gas Improvement Company, Limited, of Manchester, for supplying and fitting new machinery, for £6294; that of Messrs. W. J. Jenkins and Co., Limited, of Retford, for supplying and erecting coke-handling plant, for £3552; and that of Messrs. Butt and Co. for pipe castings, for £1157 13s. 11d. Fire-clay goods are to be supplied by Messrs. Trotter, Haines, and Corbett, Limited, and Messrs. Mobberley and Perry (equally).

The General Purposes Committee recommended that the necessary steps be taken to oppose the parliamentary powers sought by the Company proposing to manufacture and sell "Mond" gas within the borough. The Mayor (Mr. W. J. Pearman-Smith), in proposing this, said the opposition was necessary to secure the interests of the ratepayers. Mr. Powell, in seconding, said it did not follow that something would not be done to supply a cheaper kind of gas for manufacturing purposes if found practicable. Mr. Noake and Alderman Holden urged that the interests of manufacturers should be studied; and the Mayor explained that the resolution allowed full latitude to the Committee conducting the opposition. Messrs. Cope and Zeller urged that the question was a most serious one to manufacturers; and Alderman Holden asked for an undertaking that the Gas Committee would themselves manufacture this gas. The Town Clerk (Mr. J. R. Cooper) said he was informed by a gentleman of high standing that coal gas at 1s. 8d. per 1000 cubic feet was cheaper than Mond gas at 4d. The resolution was carried *nem. con.*

## ELECTRIC LIGHTING NOTES.

The electric lighting works at Nuneaton are to be extended at an outlay of £2500; the work to include the raising of the floors above the recent flood in the neighbourhood.

On the ground that they are the owners of the gas-works, the Sittingbourne District Council have sent to the Board of Trade an objection to the granting of an Electric Lighting Order to the Kent Electrical Power Distribution Company.

Ilfracombe's ardour for the electric light has somewhat abated. The District Council have rescinded the resolution by which they undertook to carry out the electric lighting of the town, and have decided to transfer the Order to a company. The reason advanced for this step is that the population is not sufficiently large to make an installation pay.

Figures have lately been published proving the falsity of a statement that Barnet was getting its street lighting done more cheaply by electricity than by gas. A protest has been made against the truth being thus made known. But "the truth will out;" and at the last meeting of the Barnet Urban District Council, the statement that electric lighting was costing much more than gas was accepted.

The Lancashire Electric Power Company, in accordance with the powers obtained last session, have offered terms to several Local Authorities in Lancashire for the supply of electricity in bulk. To the smaller urban districts, rural districts, &c., they undertake to give a supply averaging 300 hours per quarter at 1·87d. per unit; 400 hours, at 1·6d.; 500 hours, at 1·44d.; and 600 hours, at 1·33d.

Colonel A. G. Durnford held an inquiry at Harrogate on Wednesday respecting an application by the Corporation to borrow £10,000 for electric light purposes—principally generating plant. At the works there is a plant equal to supplying 26,000 8-candle power lamps, but there are in the town 30,395 lamps, though these are never all in use at the same time. The Town Clerk (Mr. J. Turner Taylor) stated that the debt at the present time on the electric lighting undertaking amounted to £68,724.

Yesterday week the Walsall Town Council agreed, on the recommendation of the Finance Committee, to raise a sum not exceeding £20,048 on mortgage in respect of loans sanctioned for the electric lighting undertaking; and, on the advice of the Electric Lighting Committee, it was decided to apply for the Local Government Board's sanction to a further loan for the same undertaking of £3000. It was mentioned by Alderman Baker that up to the end of December last the total expenditure on the electric lighting undertaking was £29,385, of which £24,402 had still to be repaid.

Persons having business in the North and South Wales Bank at Chester, at one period of the day last Saturday week, received an ugly shock, quickly made their exit, and stood gazing at the premises with considerable wonder and alarm. Their agility in leaving the building and their amazement were due to an explosion at the electric light box situated in the Manager's private office. The report, which was exceedingly loud, was instantly followed by a long flame, which, however, was eventually subdued. The explosion was attributed to high voltage. Electric lights in other establishments in the city were extinguished about the same time.

At the Bradford Town Hall, last Friday, Mr. R. H. Bicknell, M.Inst.C.E., one of the Inspectors of the Local Government Board, held an inquiry in regard to the proposal of the Bradford Corporation to borrow £140,000 for the extension of electric lighting facilities within the city. The Town Clerk (Mr. F. Stevens) stated that the outstanding loans amounted to £1,295,162, of which £287,204 (£205,244 actually raised) was on electricity account. The total now applied for was £140,000; but it was impossible to separate the amount to be allocated to lighting from that required for traction purposes. Detailed plans and estimates were handed in.

The recent failures of the electric light at Hastings, to which reference was made at the close of the article on the intensified gas lighting in that town which appeared in the "JOURNAL" last week (p. 159), were very properly brought before the Town Council at their last meeting. A local paper, alluding to the electric lighting of the town, says: "Latterly it has been scandalous; and the light has been suddenly totally extinguished on several occasions at the most inopportune hours. We hope those in authority at the electric light works are not of opinion that consumers of their product belong to the order which loves darkness rather than light. It is highly inconvenient to have the light put out in the thoroughfares where it is used. But it is infinitely worse in private houses where sole reliance is placed on the electric luminant, which has lately been distinguished for nothing so much as its unreliability. In such cases, recourse in emergency must be had to candles or lamps, neither of which are particularly agreeable alternatives."

The "Australasian Ironmonger" has recently furnished the following particulars in regard to schemes for electric lighting in Australasia: In New Zealand, the City of Auckland and the Municipality of Greytown have passed Bills through the Lower House to enable them to make arrangements for electric lighting and the supply of current for public or private purposes. It is proposed that the Waiohine River should be utilized to provide the motive power for the Greytown scheme. In Tasmania, the lighting of Devonport by electricity or gas is provided for in a Bill now before Parliament. Power is given to the Local Authorities to borrow £11,000 for carrying out the work. With this sum, either electricity or gas is to be installed for lighting and power purposes within and around the town. The work when completed is not to carry a heavier lighting rate than 2s. in the pound. In Victoria, the Melbourne Metropolitan Gas Company, being compelled to charge a uniform rate for all gas supplied, are challenging the right of the City Council to supply electricity for motive power at 3d. per unit, when the charge for lighting is 5d. and 6d. A writ of injunction has been issued by the Company to restrain the Council from continuing differential prices.

Reference was made in last week's "Notes" to the proposal of the Local Authorities of Edmonton, Enfield, Southgate, Tottenham, and Wood Green to apply to Parliament for sanction to the formation of a Joint Board to produce and supply electrical energy in those places. A meeting of Enfield ratepayers has lately been held to consider the matter, and a long discussion took place. Mr. J. J. Wilson presided, and moved a resolution sanctioning the association of the District Council with the other Councils in carrying out the scheme, for the purpose of which it is proposed to borrow £400,000. The motion was strongly supported by Mr. Trenchard, and equally strongly opposed by Mr. Fitch, who spoke very effectively; and eventually it was lost, on a show of hands, by 42 votes to 22. A poll was demanded; and it will be taken on the 11th prox. We learn from a local paper that one of the chief factors which influenced and determined the ratepayers' decision was the risk of loss on the undertaking for some years, which, with the interest on the capital outlay, would have to be met out of the rates. These (already too high) it is felt should not be enhanced by an enterprise of so uncertain a character as the one in question. Again, while a comparatively few—one-fourth, it is estimated—of the people would benefit, except in regard to the public lamps, the whole of the district would be called upon to pay for the loss. Of course, should the scheme succeed, the profits derived from those using electricity would benefit those who did not. The predominant feeling, which runs very high on the question, appears to be that each district should control its own electricity supply.

Colonel Smith, R.E., one of the Inspectors of the Local Government Board, recently held an inquiry at Kingston in regard to an application

made by the Corporation for permission to borrow a further sum of £17,800 for purposes of electric lighting. The Town Clerk (Mr. H. A. Winser) stated that between 1897 and the present time the number of lamps installed had more than doubled, and the increased demand for current could only be met by adequate plant. It was for this purpose alone that the money was required. The extensions of the buildings were estimated to cost £6750; additions to boilers, £3850; and other machinery, £4400. These items made up the £15,000 originally asked for. Since then, however, other needs had arisen to the amount of £2800, for providing exciting plant, arc lighting plant, and other things necessary for the extension of street lighting. The Borough Surveyor (Major Macaulay) explained in detail the plans for the extension of the buildings; and the Electrical Engineer (Mr. J. E. Edgcome) furnished technical details as to the machinery and mains. It was proposed, he said, to increase the arc lamps to 76, so as to have four series of 19 each. This would carry the lamps to the boundary of the borough in each direction. The Inspector inquired if the undertaking was flourishing. The Chairman of the Lighting Committee (Alderman Collings) said they thought so, judging by the number of lamps connected. Something like 4000 had been put on in nine months. Mr. Bolton objected to the further loan on the ground that the accounts submitted by the Electric Lighting Committee of the Corporation did not agree with those sent to the Board of Trade. He sharply criticized the figures, and submitted that the electric light undertaking had been carried on since its inception at a considerable loss to the ratepayers, and that further loss would be incurred if the £17,800 now asked for were granted, as it would impose an extra charge of something like £1000 a year upon the ratepayers in the form of repayment of principal and interest. The Inspector said he only wished to ask Mr. Bolton one question. They had an undertaking which was more or less a going concern; and, as far as one could make out, it was imperative for the welfare of that concern that certain extra expenditure should be incurred. If they did not lay out that money, what would happen? Mr. Bolton contended that the expenditure contemplated was not necessary for the continuance of the works. However, if it were shown that the refusal of the loan would cause the works to stop, he would withdraw his opposition, for he would be one of those who would suffer. Alderman Collings defended the action of the Committee in extending the system of arc lighting for the main thoroughfares. As to the need for the present loan, the demand for current was now greater than they could supply. With regard to the pressure on the rates, he had some figures compiled which showed that the lighting rate from 1880 to 1893 was 5d. for eleven years, 6d. for two years, and 5½d. for one year. In 1894, the first year of electric lighting, it was 7½d.; in 1895 and 1896, 9½d.; in 1897 it dropped to 7d.; in 1898 it was 6½d.; in 1899 it was 6d.; and last year it was 6½d. So that Kingston had the best system of arc lighting in the streets, and the actual difference between 1887 and 1900 was only ½d. in the pound, while the quality of the lighting was infinitely superior. The inquiry then closed.

In our contemporary "Lightning" there has lately been some correspondence on the working of the Southampton electric light undertaking. In criticizing last year's balance-sheet, the Editor of that publication said that it showed a surplus profit of £145 for the year ended March 31. To this Mr. Crowther Smith, Secretary of the Southampton Gas Company, replied; pointing out that, so far from a profit being made, there was actually a deficit. Mr. Smith had previously (in October, 1898) written to "Lightning" on the subject of the financial results of the working of the undertaking; and the Editor then promised to bear in mind the question of the deficiency shown, which was carried to a suspense account. Under these circumstances, Mr. Smith wrote:

> As I still assume that you are only desirous of publishing accurate statements of results, I must ask you to consider whether it is correct to state as you do in your "Table of Costs" that there was a surplus profit for the year ended March 31, 1900, of £145, when their net revenue account shows a balance deficit of £220 11s. 10d., and there was also in addition a deficit of £1463 3s. 10d. under the heading of "Suspense Account" at that date. I presume that you have been supplied with a copy of these accounts. I must call your attention to the fact that in your "Table of Costs" this account is called the tenth year of working, and no Borough Accountant's ingenuity can get rid of the fact that at the end of the tenth year the working of the electricity undertaking has resulted in a deficit of £1683 15s. 8d., instead of the surplus of £145 as published by you.

In reply, the Editor of "Lightning" maintained that it was quite correct to state that there had been a surplus profit of £145. He said his table showed the actual results of each complete year of operation, and did not pretend to deal with "balances" brought forward from previous years. For the period referred to, the accounts of the Southampton undertaking showed a surplus—after providing the necessary sums for interest on, and redemption of, the loan—of £145; and this was the actual financial result of the year's operations. But the Southampton Borough Accountant had debited his net revenue account with a sum of £365, representing one-fifth part of the accrued deficits of earlier years. This left the net revenue account with a deficit balance of £220. The Editor acknowledged that perhaps it would have been better if the Accountant had limited the amount of his debit towards writing off the old deficits to the extent of the actual surplus of £145, in which case the net revenue account would not have shown a deficit balance. He contended, however, that the writing off of the old deficits, no matter what the proportion might be, did not alter the fact that the past year's working, *per se*, resulted in a surplus profit, as recorded in the table, of £145. He admitted that the deficits of the earlier years aggregated £1683 15s. 8d.; but he pointed out that the bulk of them represent interest and repayment charges on the proportion of the original loan for the period during which it remained unproductive. He explained that the Corporation purchased the undertaking in 1896 for £21,000, and immediately decided upon extensions involving a further capital outlay of £34,964. In order to take advantage of the favourable state of the Money Market, the whole amount was borrowed at the start. But a considerable sum remained unspent during the first year; and to prevent an unfair burden being placed upon the revenue account for that year, the interest and repayment charges in respect of the unspent portion of the loan were charged to a suspense account. The Editor considered such procedure was perfectly justifiable from his point of view.

## RICHMOND (SURREY) WATER SUPPLY.

### An Important Report by Mr. Mansergh.

Readers of the "JOURNAL" are aware that for something like a quarter of a century the Local Authority of Richmond have been struggling to provide the town with an adequate supply of water. The circumstances under which this important service is now carried out are somewhat peculiar. Just forty years ago, the Southwark and Vauxhall Water Company introduced a Bill to sanction the purchase by them of the undertaking of the Richmond Water Company; but so great was the opposition to it that it was thrown out. The Company then had the shares in the concern transferred, and proceeded to supply the town. The character of the supply and the charges were viewed with great disfavour; and after some years' discussion, the old Select Vestry obtained powers from the Local Government Board to sink an artesian well and lay their own services. The well was partly sunk and the mains laid, when, early in 1877, the Company cut off the water. The Vestry were unfortunate in their scheme, and in 1883 they had to ask the Company for an auxiliary supply in bulk; and they have been paying 1s. per 1000 gallons for it ever since, while their neighbours only pay 6d. In 1889 a new well was sunk into the chalk, and fresh borings were tried; but to little purpose. First and last, a sum of about £100,000 has been spent, nearly half of which has yet to be repaid, and the water-rate stands at 1s. in the pound. About a year ago, the Corporation commissioned Mr. James Mansergh to examine the existing works, and advise as to the steps desirable to increase the supply. His report was duly presented to the Water Committee and carefully considered by them. After giving a detailed description of the Corporation's sources of water supply—viz., the Water Lane works, and the Terrace Gardens and Petersham Meadows wells—Mr. Mansergh deals with the present and probable future of Richmond and the quantity of water required. He assumes that the domestic use will increase to 25 gallons per head per day, and that when the area not built upon is covered, the present supply, estimated at 500,000 gallons per day, will rise to 800,000 gallons. After considering the results of the existing works, especially those carried out in the chalk (with which he is unfavourably impressed), and the prospects of any new works of a similar character, he recommends that the Southwark and Vauxhall Water Company should be approached with the view of obtaining water from them at a lower price and higher level than at present—viz., delivered into the existing service reservoir in Richmond Park. He says he knows the course he suggests will be received with disfavour, and if there were any clear or even hopeful alternative open to the Corporation, he would not recommend it; but they have been experimenting near home long enough. In a supplementary report, he quotes a letter from the Company's Engineer, from which it appears that to supply that reservoir the Company must lay a new main from their works at Hampton; and for this they required a guaranteed minimum payment of £2000 per annum, for which they would give a supply of 164,000 gallons a day—the charge being calculated at 1s. per 1000 gallons for the first 20 millions, and 6d. per 1000 gallons for the remaining 40 millions, and for any further quantity supplied beyond the 60 millions, by which arrangement it is suggested that £100 a year would be saved in the cost of pumping water at the dummy well in Water Lane.

The Water Committee, in reporting on the matter to the Council, at their meeting on the 8th inst., pointed out that such a main, laid by the Company at their own expense, meant that the payment of £2000 per annum by the Corporation would be established in perpetuity; and it was not shown that the Company had any legal right or power to lay it without first obtaining the sanction of Parliament, nor when, how, or where it would be laid or its estimated cost. Moreover, as Mr Mansergh considered the estimated future population of Richmond would want 800,000 gallons a day, the engines at the Water Lane works would still have to be kept going to pump the water supplied from the wells and adits of the Corporation and from the Petersham Meadows, in order to provide the difference between the Company's daily supply of 164,000 gallons and the 800,000 gallons, and the boilers at the water-works would also have to be kept at work, not only for the above purpose, but to drive the engines for supplying the separate mains for road watering, sewer flushing, &c. Assuming that the population of Richmond ultimately reaches 32,000, and 300,000 gallons more of water a day should be required, this could only arise from the erection of buildings on the vacant land, necessarily bringing a large assessable value, and consequent greatly increased water rates and rents; thus providing the additional funds required for payment of the contemplated increased water supply, while practically but little expense would be incurred at the water-works, except for pumping, as the engines, boilers, and pumps were equal to the extra work, and the cost of laying any further street water-mains would be defrayed by loan. The quantity of water the Southwark and Vauxhall Company were bound by the Act of 1884 to supply to the Corporation, if required, was up to but "not exceeding one million gallons a day." The Committee, being of opinion that the scheme of the proposed new main from Hampton should not be entertained, desired that the Company should be asked at what price they would supply an agreed minimum quantity of water per annum into the dummy well of the water-works. They declined to entertain the request; and after a further interview between Mr. Mansergh and the Engineer, the latter wrote to the effect that the Directors were very anxious to meet the wishes of the Corporation, and had decided that, in the event of the account exceeding £3000 per annum, they would be prepared to reduce, by a percentage to be agreed upon, the price of all water used in excess of this quantity. The Committee were of opinion that this offer ought not to be entertained, and that further negotiations with the Company appeared to be of no avail. Under the circumstances, they recommended the Council to suspend further steps in any direction, at least until the decision of Parliament as to the Water Bills of the session was known. After some remarks, the recommendation was adopted.

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The Leigh (Lancs.) Town Council have decided to erect a purifying-house, meter-house, and chemical laboratory at the gas-works at a cost of £3937 10s.

## NOTES FROM SCOTLAND.

### From Our Own Correspondent.

*Saturday.*

Yesterday afternoon the Edinburgh and Leith Gas Commissioners paid a visit of inspection to their new gas-works at Granton. Though the Committee specially in charge of the work have been frequently on the ground, the Commissioners have not paid a formal visit to the place since May last. On that occasion Mr. Kinloch Anderson was Convener of the Works Committee, and took charge of the party. He was immediately afterwards laid aside by illness, and has scarcely done any work for the Commissioners since. A day or two ago, it may be mentioned, Mr. Kinloch Anderson went to Cannes to spend the winter months; and it is the sincere wish of many in Edinburgh that he may return greatly invigorated, and able to join again in the deliberations of the Commissioners. His place has meantime been taken by Mr. Purves, of Edinburgh, a councillor who is a plumber by occupation, and who has brought an amount of intelligence and energy to the duties of his responsible office which are reassuring to all who come into contact with him. Under Mr. Purves' guidance, with Mr. W. R. Herring, the Engineer, as cicerone, the party were conducted from point to point of the great area upon which there is arising a gas-works destined to be one of the finest upon the face of the globe. It is impossible to convey it in words; but as one department after another is visited and explained, the conclusion is forced home that, so far as it is possible, perfection has been reached in the designing of these great works. The plant, in its broad conception, seems to have been selected with a view to the special requirements of the locality, and to have had as much thought bestowed upon every detail as upon the scheme generally. Not only its nature and disposition have been handled in this masterly manner, but the housing of it has been the special study of Mr. Herring; and the result, so far as is as yet visible, was a matter upon which, on Thursday, he was deservedly congratulated. He has, in the matter of these works, been the chemist who has determined what science demands; the engineer who has resolved how it is to be obtained; the architect who has designed its position and environment; and, above all, the master eye, to see that everything which is done in any one of the departments is in order. There is no denying that, when the Granton works are finished, they will contain, in every department, the foremost appliances which are to be found anywhere; and in this respect they will be unique. This was the feeling of those who saw the plans when they were first produced; it was the feeling of those who inspected the works in May last; and it is still more the feeling of those who were privileged to see them this week, in the advanced stage they have now reached.

Although it did not form part of the information conveyed to the visitors, it leaked out that before the party left Edinburgh, Mr. Herring had submitted a report to the Sub-Committee, and that in this report it was shown that he had, by retaining some portions of the work in his own hands, been able to get it done at a great saving to the Commissioners. But the subject will come up again. The report having been laid before a Sub-Committee only, cannot be made public as yet.

At a meeting of the Glasgow Town Council on Thursday, Mr. Cronin said he wished to know what steps the Gas Committee had adopted to take advantage of the reduced price of coal. Was it the case that the Committee were so fixed with their contracts that they had had to pay for almost the whole of their coal at the highest market price? Mr. Fife said he had had no notice of so important a question, and pointed out that it had been reported to the Council that contracts for coal had been made for a certain period, and that they were working under these contracts. Mr. Cronin asked if Mr. Fife would inform him whether they had lost £25,000 by fixing their contracts in this way. Mr. Fife said it was impossible to answer a question put like that. Now, Mr. Cronin is a labour leader, and is, in fact, more—he is a labour conciliator. His motive in putting the question was, no doubt, that it might be shown that by conciliation, as it is called, or perhaps rather by co-operation, working on a sliding-scale, the Corporation would have paid less for their coal than they are doing. The notion is chimerical, and need not be followed up; but from the point of view of the man who is a professional conciliator, it is quite intelligible. Of course, if in the eyes of those who agree with Mr. Cronin, his view of the situation is bright, the obverse is just as bright—which is that, if the situation had been that the £25,000 would have gone into the pockets of the workers, they would have taken it with as little (probably less) compunction, than it is assumed that the "non-conciliatory" coalmasters have done. No one would expect Mr. Cronin, in such circumstances, to put a question.

Bailie Chisholm, of Dalkeith, is the Law Agent of the coalmasters of Mid-Lothian; and these including the Lothian Coal Company, who own the Newbattle cannel field, it must be presumed that he knows something, if he has applied his mind to the subject, about gas-producing coal. Newbattle cannel is mined, if not from actually below the town of Dalkeith, from the ground immediately adjoining. Therefore, it is to be concluded, Dalkeith should be supplied with the very best gas which can be produced. Some people, including Mr. Alexander Bell, sen., the Manager of the Dalkeith Gas Company, think the gas which is supplied is the best which can be given; but there are some who, like Bailie Chisholm, believe that it is not. He has given notice of motion to the Clerk of the Dalkeith Town Council to the effect that an analysis of the gas supplied by the Company should be from time to time obtained by means of surprise visits. The matter of the gas supplied to the town was discussed at the meeting of the Council on Monday night, when Bailie Chisholm called attention to the fact that, whereas the Gas Company had some time ago publicly stated that it was 25-candle power gas that was supplied, the Company had lately issued a report made by their own Analyst and by their own particular apparatus, and it only gave 23·20 candles. An examination made by Mr. John Hunter, the Burgh Analyst, in October, showed then that, as the result of a photometrical test of the gas supply of the burgh, in accordance with the new instructions of the Metropolitan Gas Referees, the highest of six tests showed the illuminating power to be equal to 15·76 standard candles.

## GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

**Referred to on p. 200.**

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | GAS COMPANIES. | | | £ s. d. |
| 590,000 | 10 | Oct. 12 | 10½ | Alliance & Dublin 10 p.c. | 19—20 | .. | 5 5 0 |
| 100,000 | 10 | ,, | 7½ | Do. 7 p.c. | 13⅞—14½ | .. | 5 3 5 |
| 300,000 | 100 | Jan. 2 | 5 | Australian 5 p.c. Deb. . | 99—101 | .. | 4 19 0 |
| 200,000 | 5 | Nov. 14 | 6 | Bombay, Ltd. . . . | 6—6¼ | .. | 4 12 4 |
| 40,000 | 5 | ,, | 6 | Do. New, £4 paid | 4—4¼ | .. | 5 6 8 |
| 380,000 | Stk. | Aug. 15 | 12 | Brentford Consolidated | 257—262 | +2 | 4 11 7 |
| 270,000 | ,, | ,, | 9 | Do. New . . . | 183—188 | .. | 4 15 9 |
| 50,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. . | 130—135 | −7 | 3 14 1 |
| 159,375 | ,, | Dec. 13 | 4 | Do. 4 p.c. Deb. . | 115—118 | .. | 3 7 10 |
| 220,000 | Stk. | Sept. 14 | 10 | Brighton & Hove Orig. | 220—230 | .. | 4 6 11 |
| 226,320 | ,, | ,, | 7 | Do. A. Ord. Stk. . | 150—160 | .. | 4 7 6 |
| 1,003,500 | Stk. | Aug. 29 | 5 | Bristol, 5 p.c. max. . | 121—123 | .. | 4 1 4 |
| 420,000 | 20 | Sept. 28 | 10 | British. . . . . | 39—41 | .. | 4 17 7 |
| 50,000 | 10 | Aug. 15 | 12 | Bromley, Ord. 10 p.c. . | 24—26 | .. | 4 12 4 |
| 79,000 | 10 | ,, | 9 | Do. 7 p.c. . . . | 19—21 | .. | 4 5 8 |
| 500,000 | 10 | Oct. 12 | 6 | Buenos Ayres (New) Ltd. | 8¼—8⅝ | .. | 6 17 2 |
| 220,000 | Stk. | Dec. 28 | 4 | Do. 4 p.c. Deb. | 93—98 | .. | 4 1 8 |
| 150,000 | 20 | July 12 | 8¼ | Cagliari, Ltd. . . . | 23—25 | .. | 6 12 0 |
| 100,000 | 10 | Sept. 28 | 8 | Cape Town & Dis., Ltd. | 13⅜—14½ | .. | 5 10 4 |
| 50,000 | 50 | Nov. 2 | 6 | Do. 6 p.c. 1st Mort. | 53—55 | .. | 5 9 1 |
| 550,000 | Stk. | Oct. 12 | 12½ | Commercial Old Stock | 275—280 | .. | 4 11 1 |
| 236,425 | ,, | ,, | 9½ | Do. New do. . | 207—212 | .. | 4 12 0 |
| 238,237 | ,, | Dec. 13 | 4½ | Do. 4½ p.c. Deb. | 132—137 | .. | 3 5 8 |
| 800,000 | Stk. | Dec. 13 | 9 | Continental Union, Ltd. | 165—170 | .. | 5 5 11 |
| 200,000 | ,, | ,, | 7 | Do. 7 p.c. Pref. | 165—170 | .. | 4 2 4 |
| 555,000 | Stk. | Aug. 15 | 5¼ | Crystal Palace Ord. 5 p.c. | 117—122 | .. | 4 6 1 |
| 60,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 130—135 | .. | 3 14 1 |
| 486,090 | 10 | July 27 | 11 | European, Ltd. . . . | 18½—19⅝ | .. | 5 12 10 |
| 354,060 | 10 | ,, | 11 | Do. £7 10s. paid | 13⅜—14⅝ | .. | 5 13 9 |
| 15,079,885 | Stk. | Aug. 15 | 4⅜ | Gas-light and Coke | 4 p.c. Ord. . . | 98—100 | +4 | 4 8 0 |
| 2,600,000 | ,, | ,, | 3½ | | 3½ p.c. max. . | 92—94 | .. | 3 14 6 |
| 3,799,735 | ,, | ,, | 4 | | 4 p.c. Con. Pref. | 115—118 | .. | 3 7 10 |
| 3,993,975 | ,, | Dec. 13 | 3 | | 3 p.c. Con. Deb. | 91—93 | +½ | 3 4 6 |
| 70,000 | 10 | Oct. 26 | 8 | Hongkong & China, Ltd. | 13—14 | .. | 5 14 4 |
| 3,800,000 | Stk. | Nov. 14 | 10 | Imperial Continental . | 203—208 | .. | 4 16 2 |
| 473,600 | Stk. | Aug. 15 | 3½ | Do. 3½ p.c. Deb. Red. | 100—102 | .. | 3 8 8 |
| 561,000 | Stk. | Aug. 30 | 10 | Liverpool United A . | 231—234 | .. | 4 5 6 |
| 678,100 | ,, | ,, | 7 | Do. do. B . | 173—175 | .. | 4 0 0 |
| 306,083 | ,, | Dec. 28 | 4 | Do. do. Deb. Stk. | 120—122 | .. | 3 5 7 |
| 75,000 | 5 | Dec. 13 | 6 | Malta & Medn., Ltd. . | 4⅜—5⅛ | .. | 5 14 3 |
| 580,000 | 100 | Oct. 1 | 5 | Met. of | 5 p.c. Deb. | 105—108 | .. | 4 12 7 |
| 250,000 | 100 | ,, | 4½ | Melbourne | 4½ p.c. Deb. | 104—106 | .. | 4 4 11 |
| 541,920 | 20 | Nov. 14 | 3½ | Monte Video, Ltd. . . | | 9⅛—10⅛ | .. | 6 13 4 |
| 667,946 | Stk. | Aug. 30 | 9½ | Newc'tle & G'tesh'd Con. | | 220—222 | +1 | 4 3 4 |
| 299,855 | Stk. | Dec. 28 | 3½ | Do. 3½ p.c. Deb. | | 101—102 | .. | 3 8 8 |
| 150,000 | 5 | Nov. 29 | 8 | Oriental, Ltd. . . . | 7—7⅛ | .. | 5 6 8 |
| 135,000 | 5 | ,, | 8 | Do. New, £4 10s. pd. | 5½—6 | .. | 6 0 0 |
| 15,000 | 5 | ,, | 8 | Do. do. 1879, £1 pd. | 1⅝—1¾ | .. | 4 11 5 |
| 60,000 | 5 | Sept. 28 | 7 | Ottoman, Ltd. . . . | 5—5⅛ | .. | 6 7 3 |
| 851,070 | 10 | Oct. 12 | 7 | River Plate Ord. . . | 10—10⅛ | .. | 6 13 4 |
| 250,000 | Stk. | Dec. 28 | 4 | Do. 4 p.c. Deb. . | 98—100 | .. | 4 0 0 |
| 250,000 | 10 | Sept. 28 | 8 | San Paulo, Ltd. . . . | 11—12 | .. | 6 13 4 |
| 135,000 | Stk. | Sept. 14 | 10 | Sheffield A . . . . | 232—236 | .. | 4 4 9 |
| 209,700 | ,, | ,, | 10 | Do. B . . . . | 232—236 | .. | 4 4 9 |
| 447,427 | ,, | ,, | 10 | Do. C . . . . | 232—234 | .. | 4 5 6 |
| 5,641,885 | Stk. | Aug. 15 | 5¼ | South Met., 4 p.c. Ord. | 133—136 | .. | 3 18 5 |
| 1,520,000 | ,, | Jan. 16 | 3 | Do. 3 p.c. Deb. . . | 93—96* | .. | 3 2 6 |
| 380,940 | Stk. | Nov. 14 | 5 | Southampton Ord. . . | 107—112 | .. | 4 9 3 |
| 70,825 | ,, | Jan. 16 | 4 | Do. 4 p.c. Deb. | 115–120* | .. | 3 6 8 |
| 120,000 | Stk. | Aug. 30 | 6 | Tottenham | A. 5 p.c. | 113—118 | +1 | 5 1 8 |
| 250,520 | ,, | ,, | 4½ | and | B. 3½ p.c. | 85—90 | .. | 5 0 0 |
| 61,550 | ,, | Dec. 13 | 4 | Edmonton | 4 p.c. Deb. | 107—112 | −3 | 3 11 5 |
| 182,380 | 10 | Jan. 16 | 5 | Tuscan, Ltd. . . . . | | 7⅛—8⅝* | +⅛ | 5 17 8 |
| 149,900 | 10 | Jan. 2 | 5 | Do. 5 p.c. Deb. Red. | | 97—102 | +2 | 4 18 0 |
| | | | | WATER COMPANIES. | | | |
| 780,499 | Stk. | Dec. 28 | 11 | Chelsea, Ord. . . . | | 303—308 | .. | 3 11 5 |
| 150,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. . | | 155—160 | .. | 3 2 6 |
| 160,000 | ,, | ,, | 4½ | Do. 4½ p.c. Pref. '75 | | 142—145 | .. | 3 2 1 |
| 175,785 | ,, | Sept. 28 | 4½ | Do. 4½ p.c. Deb. . | | 143—148 | .. | 3 0 10 |
| 1,720,560 | Stk. | Oct. 12 | 7 | East London, Ord.. . | | 194—199 | +1 | 3 10 4 |
| 654,740 | ,, | Dec. 13 | 4½ | Do. 4½ p.c. Deb. . | | 147—152 | .. | 2 19 3 |
| 797,687 | ,, | ,, | 3 | Do. 3 p.c. Deb. . | | 96—98 | .. | 3 1 3 |
| 700,000 | 50 | Dec. 13 | 8 | Grand | 10 p.c. max.. | 109—112 | .. | 3 11 5 |
| 310,000 | Stk. | Sept. 28 | 4 | Junction | 4 p.c. Deb.. | 130—135 | .. | 2 19 3 |
| 708,000 | Stk. | Aug. 30 | 14 | Kent . . . . . | | 303—308 | .. | 4 10 11 |
| 160,000 | ,, | ,, | 7 | Do. New, 7 p.c. max.. | | 200—210 | .. | 3 6 8 |
| 1,043,800 | 100 | Dec. 28 | 10½ | Lambeth, 10 p.c. max.. | | 290—295 | .. | 3 11 2 |
| 406,200 | 100 | ,, | 8 | Do. 7½ p.c. max.. | | 208—213 | .. | 3 15 1 |
| 350,000 | Stk. | Sept. 28 | 4 | Do. 4 p.c. Deb.. | | 127—130 | .. | 3 1 7 |
| 500,000 | 100 | Aug. 15 | 14 | New River, New Shares | | 415—420 | .. | 3 6 8 |
| 1,000,000 | Stk. | July 27 | 4 | Do. 4 p.c. Deb.. | | 128—133 | .. | 3 0 2 |
| 902,300 | Stk. | Dec. 13 | 7 | South-wark and | Ord. . . . | 193—198 | .. | 3 10 8 |
| 126,500 | 100 | ,, | 7 | | 7½ p.c. max. | 175—180 | .. | 3 17 9 |
| 489,200 | Stk. | ,, | 5 | | 5 p.c. Pref. . | 155—160 | .. | 3 2 6 |
| 1,019,585 | ,, | Oct. 12 | 4 | Vauxhall | 4 p.c. A Deb. | 128—133 | .. | 3 0 2 |
| 1,155,066 | Stk. | Dec. 13 | 10 | West Middlesex. . . | | 280—290 | .. | 3 9 0 |
| 200,000 | ,, | ,, | 4½ | Do. 4½ p.c. Deb. . | | 140—145 | .. | 3 2 1 |
| 200,000 | ,, | Sept. 14 | 3 | Do. 3 p.c. Deb. . | | 98—100 | .. | 3 0 0 |
| | | | | | | *Ex. div. | | |

Provost Lucas and Mr. Handyside expressed the opinion that the Gas Company would have no objection to a mutual analysis; but another member pointed out that they did not want to know the quality of the gas in the works, but how it stood when it reached the meters. Accordingly, Bailie Chisholm gave notice for the consideration of the matter at the February meeting of the Council, with a view to an independent analysis. Here the statement, which cannot be verified, is repeated, that the illuminating power of the gas supplied in Dalkeith is only of 15 odd candle power; and a photometrical test which must have been an inefficient one is put forward as the foundation for a proposal that a species of detective should be employed to discover if the Company are or are not supplying what they profess to do. The Company are under no obligation to supply gas of any particular illuminating power. If they say they furnish gas of a certain quality, and supply a worse, their conduct will be very heinous. But Bailie Chisholm does not say they do. He says that the Burgh Analyst says it; and he wishes the Corporation to provide ways and means of backing up the Burgh Analyst. The motion of which he has given notice comes up in February; and we shall then see whether Bailie Chisholm has anything better to put before the Corporation, as a basis for further procedure, than the results arrived at by the Burgh Analyst, which, as I have shown before, are altogether unreliable. If Dalkeith gas is to be tested officially, it must be in a manner more in accordance with "the new Instructions of the Metropolitan Gas Referees" than has yet been at all possible in Dalkeith.

When it is considered how much encouragement is given to those who speculate in electric lighting, it is wonderful how little attention is given to the improvement of lighting by gas. The Corporation of Edinburgh have forged ahead, proportionately, in the matter of electric lighting, beyond any other corporation in the United Kingdom. They have done nothing for gas lighting. They are, in fact, sneered at for having the worst lighted town in the kingdom. I do not assent to this, as I have been in other large towns where a few streets were well lighted, but the great majority were lighted miserably. I do, however, not assent, but assert, that the public lighting of Edinburgh by gas is a scandal. About two years ago the Gas Commissioners, in default of the Corporation doing anything in the matter, obtained permission to light certain thoroughfares by means of incandescent gas-lamps. These have since been in use, and have given universal satisfaction; but there is no appearance of the Corporation thinking it time to take over the lighting. On the contrary, this week it was agreed, at a meeting of the Town Council, to give to the Welsbach Company and to Messrs. Sugg and Co. permission to experiment with their systems of lighting in certain thoroughfares. The town are to provide the lamp-posts and double the quantity of gas—3 to 4 cubic feet per hour—and the experimenters are to fit up their apparatus. If the lamps are approved of, the Corporation will take them over; if not, they must be removed by the experimenters. This is about the greatest exhibition of impotency in the matter of public lighting which could be imagined. A great Corporation like that of Edinburgh should be able to do their own experimenting in public lighting at their own expense.

The "Dundee Advertiser" of Wednesday says that the subject of gas coal "was before a meeting of the Water and Gas Committee of the Dundee Town Council last night, when the returns of coal analyzed and compared with the analysis upon which the contracts had been made were produced. It appeared that there were still some defaulting contractors; and the Manager was instructed to write them on the subject. In regard to one or two of them who had been previously warned, the loss in respect of defective coal supplied during the last two months was ordered to be deducted from their accounts which had not yet been paid."

A new Act of Parliament, known as the Town Councils (Scotland) Act, promoted by Mr. A. Asher, Q.C., M.P., came into force on the 1st inst. Its objects are to improve various matters of procedure in municipal matters. One of the provisions is the doing away with commissions for the transaction of corporation business, and the merging of the powers of all such bodies in the town council of the burgh. This provision applies to not a few places in Scotland. Among others, the Gas Corporation of Forfar have become extinct, and their work will, in future, be performed by the Forfar Town Council. This body has, so far as I have seen, made the most formal adoption of the Act of all the municipal bodies in Scotland. At their meeting on Wednesday night, they not only noted that they had become a new body, but they, in formal manner, re-appointed all the officials of the superseded bodies to be officials under the Town Council, and, similarly, all the Committees were appointed Town Council Committees.

The question of whether or not there should be a gas transfer at Newport (Fifeshire) occupied the attention of the Town Council on Monday night, and did not result in anything being done. It appeared that a Committee of the Directors of the Gas Company had resolved to defer consideration of the subject until the decision of the Commissioners upon the value of the undertaking had been ascertained. This is just what the Commissioners do not wish to arrive at, and so they have postponed consideration of the subject till April 15, in order that further information may be obtained. It is suggested that the Gas Company should be approached with the view of procuring the opinion of an expert upon the valuation. The Commissioners, it appears, have offered £8500 for the undertaking; and they might even go the length of £9000. This, it was stated, is equal to 30s. per £1 share; and some of the Commissioners are indignant at the idea that the Gas Company should not accept it. The Commissioners are in favour of an amicable arrangement, in preference to arbitration. I am afraid that, if they are to secure their object, they will require to offer a little more than they are doing.

The Walsall Town Council have resolved that objections be lodged with the Board of Trade to the application of the South Staffordshire Water-Works Company for a Provisional Order authorizing them to raise £300,000 of additional capital, with the object of obtaining the insertion of clauses compelling the Company to make provision for securing a supply of pure water from Barr Beacon reservoir, and generally for the improvement of the supply of water to the borough.

The "CZARINA."

SEASON 1900-1.

WRIGHT'S

GAS-FIRES

Unequalled,

Unapproached, and

Without Imperfection.

New complete Catalogue (with Particulars of New Designs) upon application.

JOHN WRIGHT & CO.

(Now JOHN WRIGHT & EAGLE RANGE, LIMITED),

BIRMINGHAM, LONDON, MANCHESTER, AND BRISTOL.

## CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 19.

**Sulphate of Ammonia.**—The market opened very firm, and full prices were paid. But towards the close, it has become rather quiet, although the quotations remain £10 17s. 6d. per ton f.o.b. Hull, £11 f.o.b. Liverpool, and £11 2s. 6d. f.o.b. Leith. For prompt delivery consumers are still apathetic, being already fairly well covered. For spring months, however, there is good inquiry, but buyers will not pay makers' prices.

**Nitrate of Soda** is firm at 8s. 4½d. per cwt. for good, and 8s. 7½d. for refined, quality.

LONDON, *Jan.* 19.

**Tar Products.**—The benzol market has quietened down somewhat; and although 90's are moving off pretty freely on old contracts, new business is not so urgent. Fifties benzols are distinctly neglected; and buyers are hoping to purchase for forward delivery at lower rates. There is no relief in respect to creosote and tar oils, which are now a complete drug; and distillers with small storage are at their wit's end. It is difficult to account for the extraordinary falling off in the demand for creosote, especially having regard to the open weather that has prevailed so far during the winter. There is a moderate demand for naphthas, which, on the whole, maintain their value. Carbolic acid is firm; and there are important inquiries for summer delivery. The demand for naphthalene in its various forms is good, while anthracene is still neglected.

The week's values may be taken at: Tar, 13s. 6d. to 17s. 6d. Pitch, east coast, 32s.; west coast, 29s. Benzol, 90's, 10d. to 1s., according to position; 50's, 1s. 1d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Crude naphtha, 4½d. Heavy naphtha, 1s. Creosote, 1d. Heavy oils, 2d. Carbolic acid, 60's, 2s. 7d. Naphthalene, 90s.; salts, 60s. Anthracene, nominal, "A," 3d.; "B," 2d.

**Sulphate of Ammonia.**—Prices continue steady for this article; £11 to £11 2s. 6d. per ton, less 3½ per cent., being the value at most ports. There is a good deal of inquiry for spring delivery; and it is not unlikely that somewhat higher prices may be obtained in that position.

**Difficulties of the Tynemouth Water Department.**—The water question (says the "Newcastle Chronicle") has been before the Tynemouth Town Council for several years. Not content with the service of the late Water Company, they obtained parliamentary powers to take over the water supply, and ultimately became the Water Authority. Their troubles began early, and have continued down to the present time. But the worst of it is that unfortunate occurrences have followed each other in quick succession. The discovery with regard to the Moorhouses reservoir created a sensation some months ago; but, so far, no official declaration has been made as to how the matter really stands. During the past few days, another discomforting rumour has been set afloat in reference to the Font reservoir. This has also yet to be reported upon by the experts; and, therefore, no information could be vouchsafed at the last Council meeting.

## COAL TRADE REPORTS.

**From Our Own Correspondents.**

**Lancashire Coal Trade.**—The demand for all descriptions of fuel is being generally sufficiently well maintained to take away what collieries are raising. In fact, stocks, if anything, have been rather on the decrease than otherwise since the commencement of the year; and careful inquiries made during the past week show that, perhaps with the exception of some half-dozen of the large collieries in the West Lancashire district, which usually hold stocks, and of the collieries in the Manchester district, there are very few pits where any quantity of fuel is held on the banks. Even where stocks are held, they are much lower than usual—consisting, in the West Lancashire district, chiefly of the lower qualities of fuel, and in the Manchester district of house-fire descriptions. Under these conditions, prices continue firm at recent quoted rates; ranging from 16s. 6d. to 17s. 6d. per ton at the pit for the best qualities of round coal, 15s. to 15s. 6d. for seconds, 13s. 6d. to 14s. for common house coal, and 12s. to 12s. 6d. for steam and forge coal. As to slack, the question which is just now engaging most attention in the market here is the increasingly keen competition from Yorkshire. For some time past, Yorkshire collieries have been sending into Lancashire markets fuel at very much below the local prices; and this cutting in prices on the part of Yorkshire collieries, which is regarded in Lancashire as altogether unnecessary, seems not unlikely to bring about a break-up of the understanding between Lancashire and Yorkshire, which during the past two years has practically done away with any real competition for the gas-coal contracts. The friction between the two counties has, indeed, become so intense, that at a meeting of Lancashire coalowners a suggestion was put forward, and received very strong support, that some 30,000 tons of fuel should be "pooled" by the Lancashire collieries, and rushed upon the Sheffield and other markets at any price sufficiently low to drive similar Yorkshire fuel out of even their own markets. In fact, one colliery representative was prepared to come down as low as 1s. per ton, if that were necessary, to teach the Yorkshire coalowners a lesson. What the outcome of all this will be when the gas-coal contracts come upon the market during the next two or three months, remains to be seen; but undoubtedly if such ill-feeling springs up between Lancashire and Yorkshire coalowners, it must be to the advantage, ultimately, of buyers of gas coal. The shipping trade remains quiet, with only in exceptional cases more than 14s. 6d. per ton obtainable for ordinary steam coal, delivered at the ports on the Mersey. For Lancashire cokes, prices remain steady at late rates, averaging 18s. to 20s. for furnace, and 28s. to 30s. for the best foundry qualities. But in other districts which supply this market, prices are easier; Yorkshire furnace cokes being readily obtainable at 14s. at the ovens, and the Durham coke makers having made a reduction of 2s. 6d. on recent quoted rates.

**Northern Coal Trade.**—The colder weather has given a little more animation to the coal trade of this district; but with an adequate production, there has been very little effect on the prices. Best Northum-


# CARBURETTED WATER-GAS APPARATUS

**Merrifield—Westcott—Pearson Patents.**

**The Economical Gas Apparatus Construction Co., Ld.**

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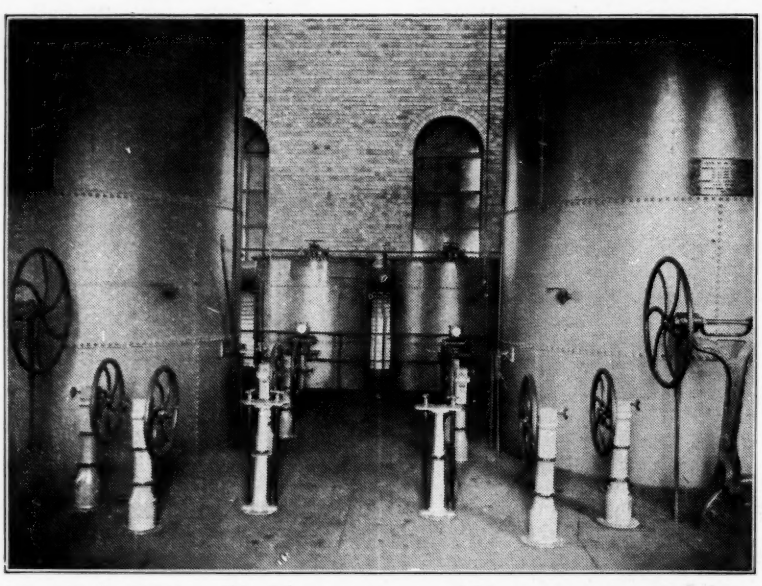
**CARBURETTED WATER-GAS ENGINEERS.**

**THE M.-W.-P. PLANT is designed to use the Heaviest as well as the Lightest Grade of Oil.**



**RESULTS PROVE EFFICIENCY.**

**Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.**
**The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 10 MILLION CUBIC FEET.**

brian steam coals are about 13s. 3d. to 13s. 6d. per ton f.o.b., and steam smalls are 6s. 9d. The collieries are fully employed; but there is no pressure in the demand. In the gas coal trade, requirements are very heavy; but there is also an abundant supply, so that, with the fall in the shipments that is usually shown about this time, there is a slight ease in price. For best Durham gas coals, the quotation for occasional cargoes may now be put as about 12s. 6d. per ton—a considerable reduction even on the prices of contracts that have some months to run. Coke is weaker; the demand having been reduced. For export coke, the quotation is still 20s. to 21s. per ton f.o.b. For blast-furnace coke 16s. at the furnaces is quoted. Gas coke is naturally affected by the weakness in other kinds of fuel; and though the export season is not reached, there is no doubt that gas coke will show an appreciable reduction from the prices of three months ago.

**Scotch Coal Trade.**—The official report is that the tone is firmer; but the indications are not in this direction. There are many works which are still "closed for the holidays." But the real reason is that they cannot take orders unless they get cheaper coal; and while this lasts forward orders cannot be looked for. The coalowners' representatives met and formulated a proposal for the reduction of miners' wages, on account of the fall in the price of coal. The miners, in opposition to this, are taking a ballot as to whether they should not reduce the output, so as to keep prices up. The feeling among those who know how matters stand is that whether the miners' wages are reduced or not, the demand for coal will not improve unless prices can be kept low. If the miners resolve upon a struggle for high wages, it will only tend to keep prices up; and they will thus not help trade. The probability is, therefore, that any struggle with the miners which may be impending will be of only short duration, and that low prices may be expected to rule during the year. The rates quoted are: Main 10s. 6d. to 10s. 9d. per ton f.o.b. Glasgow, ell 12s. to 13s., and splint 12s. to 12s. 6d. The shipments for the week amounted to 124,556 tons—an increase of 29,958 tons upon the preceding week, and of 1157 tons upon the corresponding week of last year. For the year to date, the total shipments have been 253,737 tons—an increase of 15,417 tons upon the same period of last year.

**Manchester Deputation Inspect Intensified Gas Lighting in London.**—A deputation, representing the Gas Committee of the Manchester City Council, visited London last Tuesday, for the purpose of obtaining information respecting the most recent installations for illumination by intensified gas. On Tuesday and Wednesday evenings they inspected a considerable number of such installations, and were much impressed by the excellence of the new light. We understand that they came to the conclusion that the adoption of it in Manchester, particularly in large open places, will be a great public boon, even beyond what is obtainable from the electric light. Among the places visited were Marylebone Station, the Law Courts, and Wellington Street, Strand. At the fortnightly meeting of the Gas Committee last Friday, it was resolved to ask the Engineer (Mr. J. G. Newbigging) to draw up a report upon the subject.

**London County Council and the Gaslight and Coke Company's Capital.**—At the meeting of the London County Council to-day, the Public Control Committee will report that Sir Robert Giffen, K.C.B., acting as Referee for the Board of Trade, held an inquiry on the 18th ult. with regard to an application of the Gaslight and Coke Company for the sanction of the Board to the raising of further capital during the next three years to the amount of £219,000 within their parliamentary borrowing powers. The Committee instructed the Solicitor and Comptroller to represent the Council at the inquiry; and the City Corporation were represented by their Solicitor and several members of the Corporation. The Solicitor of the Council reminded the Referee that the Council, on behalf of the gas consumers of the Metropolis, would look to him to satisfy himself as to the necessity for the increase of capital. The City Solicitor objected to works being carried out which were not absolutely necessary until Parliament had pronounced upon the Company's Bill of next session. (This objection related more particularly to a sum of about £40,000, required for the laying of a new trunk main.) The Committee understand that the Referee was satisfied that the money asked for was required, and that the Company would, in the course of a few days, receive the sanction of the Board of Trade to raise it as provided for by section 18 of their Act of 1876.

**Cromer Water Supply.**—An extraordinary meeting of the Cromer Water Company was held on Monday last week to pass resolutions in favour of the Bill to be introduced next session for the re-incorporation of the Company with extended powers. The present authorized share capital is £20,000, and they desire to increase it by £29,000, the estimated cost of contemplated works. Mr. B. Rust presided. The Secretary (Mr. Hansell) said by the powers now sought the Company's area would be limited to parishes within a five-mile radius. In a memorandum, the Directors explained that the continued growth of the Company's district had necessarily largely increased the demand for water, and in the autumn of 1899 the Directors instructed their Consulting Engineer (Mr. J. C. Melliss) to report on the duplication of parts of the existing works. His estimate of the cost, including the provision of additional mains for supplying the higher parts of the town, came to nearly £5000. Before deciding to incur this large expense, the Directors consulted Mr. Clement Reid, F.R.S., who advised that a supply from a fresh source should be obtained, and that the most satisfactory source would be a well sunk in the chalk at such a distance from the sea that it would be possible to pump freely from it. Before coming to a decision, the Directors decided to instruct Mr. W. Whitaker, F.R.S., to report on the subject independently of Mr. Reid. Mr. Whitaker visited the district, and agreed with the conclusion arrived at by Mr. Reid. The Directors then instructed Mr. Melliss to report thereon; and he recommended that a well should be sunk on a site at Metton, situated about 3¾ miles from the sea, where the chalk is met with at a depth of about 113 feet from the surface, and that a reservoir should be constructed on a site in the parish of Aylmerton, giving a top-water level of 302 feet above Ordnance datum. The resolutions approving the Bill were passed.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**Partial Failure of the Gas Supply at Coalville.**—Some inconvenience was experienced in Coalville, Hugglescote, and district last Friday week owing to the temporary failure of the gas supply. In consequence of this, parts of the district were almost in darkness. In several shops and in private houses, candles and lamps had to be resorted to; and where the gas supply had not given out, the light was poor and unsatisfactory.

**Incandescent Gas Lighting in Salisbury.**—Under the energetic action of Mr. Norton H. Humphrys, the Engineer of the Salisbury Gas Company, a great extension has lately been witnessed in the use of incandescent gas lighting in the city. The Congregational Church has just been fitted with the new system, which was inaugurated on the first Sunday in the new century. The 52 Welsbach burners employed replace more than three times this number of ordinary flat-flames with very good results—the light being steady and brilliant. A similar improvement has been effected at St. Thomas's Church, where each Welsbach No. 3 burner replaces a cluster of five flat-flames. At the Council Chamber, the lighting of the banqueting-room and the Crown Court have been improved in a similar manner; and for some months the Infirmary has been lighted throughout with incandescent gas-burners. The Conservative and Liberal Clubs have also adopted this system.

**Richmond Gas Company and Electric Lighting.**—At a recent meeting of the Richmond Town Council, the General Purposes Committee reported that the Richmond Electric Light and Power Company, Limited, had applied for the Corporation to carry out clause 2 of the agreement between them and Messrs. Latimer Clark, Muirhead, and Co., Limited, and to oppose the Gas Company's Bill at the Electric Light Company's expense. The clause referred to is as follows: "So long as the terms of this agreement shall be faithfully performed by the Contractors or their assigns, the Local Authority shall, at the cost of the Contractors, use their utmost endeavours to prevent any other company from acquiring the right to supply electricity for any public or private purposes as defined by the Electric Lighting Act, 1882." The Committee recommended the Council to comply with the application, and to authorize them to prepare a petition against the Bill in the interests of the Council and other gas consumers as well as of the Electric Light Company. Mr. Lucas observed that those who supported the agreement with the Electric Light Company ought to go about in sackcloth and ashes. There was very little for them to thank the Company for, and the Council should let them fight their own battles, and at their own expense. Mr. Thompson characterized the clause referred to as bad and dangerous; tying the Council, as it did, hand and foot to the Electric Light Company, and also binding them to prevent anyone else coming in during the next thirty years to supply electric light at a reasonable figure. The tradesmen of Richmond, he said, were mulct to the extent of £2000 a year more than those of Kingston in regard to electric light; and it would be to the advantage of the borough if there were competition between the Electric Light Company and the Gas Company. The recommendation was carried.

**Gas Workers' Wages at Smethwick.**—At the meeting of the Smethwick Town Council last Tuesday, the Gas Committee reported that an application had been made from the gas workers for increased wages and other concessions; and, after meeting a deputation, they had decided to advance the wages of stokers, firemen, and pipe-jumpers 3d. per shift, and the wages of pipe-trenchers and yardmen from 21s. to 22s. 6d. per week, and to pay time-and-a-half for Christmas Day and Good Friday, the same as for Sundays. The report was adopted

**A Dangerous Method of Examining a Tar-Tank.**—As the result of thoughtlessness, an explosion occurred at the works of the Durham Gas Company last Tuesday. Happily, the results were not serious; but they might have been, and a record of the occurrence may serve as a warning to others. It is usual to convey quantities of tar, &c., from the works to the goods station at Gilesgate in a large iron tank drawn by horses. This tank was being loaded at the works by the driver, named Willis, and other men; and as darkness was setting in, the men, in order to find out whether the tank was nearly full, took off a manhole lid and held a lighted candle to it. A loud explosion followed; and all the men were more or less burnt about the head and face. Willis, the driver, was so much worse than the others that he had to be detained at the infirmary.

**Accident to a Gasholder at Haverfordwest.**—Soon after seven o'clock last Saturday week, the greater portion of Haverfordwest was suddenly plunged in darkness owing to the failure of the supply of gas It was found that the supports of the principal holder at the gas-works had fallen away through (report says) decaying foundations, and the huge structure sank, causing a tremendous escape of gas, and effectually cutting off the supply to the lower portions of the town. It was not until about nine o'clock that a smaller holder was able to furnish a limited supply, and then the light was very meagre. Meanwhile the street-lamps had gone out; and all the important business establishments found themselves in darkness. The worst sufferer was the Great Western Railway. The lights of the station, signal-boxes, and signals suddenly failed just after the departure of the up mail train. Temporary means were found for relieving the difficulty on the line.

**Dover Corporation and the Gas Company's Bill.**—Prior to the promotion by the Dover Gas Company of their Bill for next session, they obtained the consent of the Corporation to an application for a Provisional Order, subject to the following conditions: (1) Union Road to be widened 35 feet; (2) mains to be laid in new streets when required by the Corporation, and before making good; (3) trenches to be repaired by the Corporation at the Company's expense; (4) present and future works to be considered extraordinary traffic under the Highway Acts; (5) a reduction of 10 per cent. in the cost of gas supplied to the public lamps. The only condition to which exception was taken by the Company was the one in reference to the widening of Union Road, the width of which they stipulated should be 34 ft. 4 in. instead of 35 feet. Now that the Company have notified their intention of applying for a Bill, steps will be taken by the Town Council to have clauses inserted therein providing for the matters already agreed to.


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**Incandescent Gas Lighting Scheme at Southport.**—Southport streets will soon present (and many of them already do so) a very different aspect at night time. The conversion of the gas-lamps to incandescents is being actively pursued; and already close on 600 burners have been fixed. The scheme comprises nearly fifty thoroughfares.

**Coal in Kent.**—The inhabitants of the Isle of Thanet and of East Kent generally have lately been much excited at the prospect of shortly having a good supply of coal at a greatly reduced cost. From the report of the Deputy Chairman of the Kent Consolidated Coal Company, it is expected that in three or four months the first seam of coal will be reached.

**Dividend of the Gaslight and Coke Company.**—We learn from the Secretary and General Manager of the Gaslight and Coke Company, Mr. John W. Field, that the accounts for the half year ending Dec. 31 last show that (subject to audit) the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the statutory rate of £4 8s. per cent. per annum, carrying forward a balance of £221,570 10s. 5d. This time last year the dividend was £4 18s., and the balance to the good £193,333 8s. 4d.; while in August the former was £4 8s., and the latter £296,755.

**Mond Gas Scheme Opposition.**—The proposal of the promoters of the Mond gas scheme to erect works on the Dartmouth Road allotments at Smethwick has raised quite a storm in the neighbourhood. A deputation attended the Town Council last Tuesday to protest against the proposal; and petitions were presented signed by 700 inhabitants and 115 allotment holders. The Walsall Town Council have decided to put in an appearance against the Company's Bill; and at the meeting of the West Bromwich Town Council last Wednesday, it was resolved to take the steps necessary to oppose the Bill, or to obtain such modification as might be deemed advisable. A deputation was also appointed to attend any conference of local authorities that might be convened on the subject.

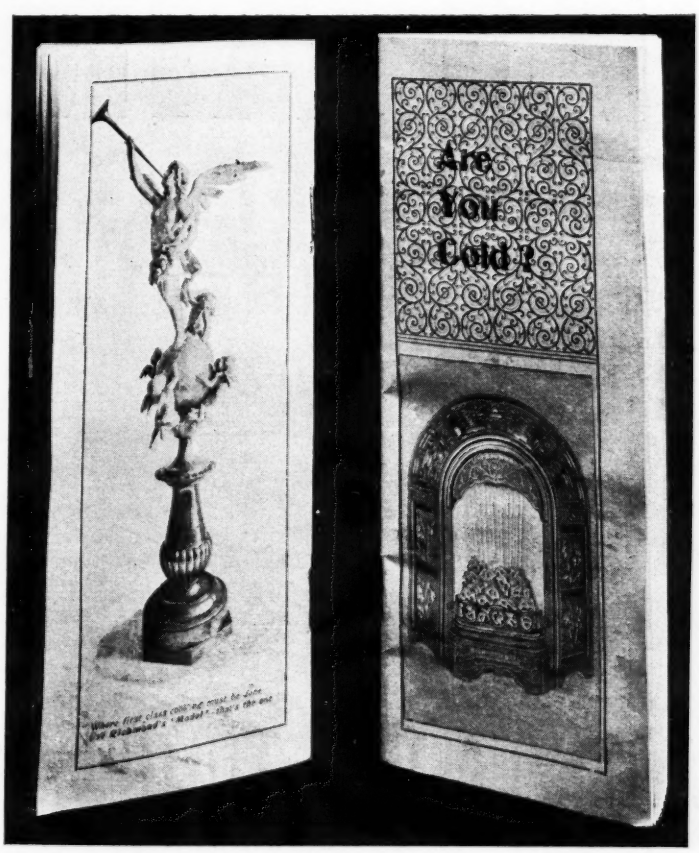
**Gas Question at Golborne.**—Last Wednesday, a meeting of the ratepayers of Golborne was held in regard to the gas question. The Golborne Gas Company are promoting a Bill to extend their powers; but since the initial step was taken, the Leigh Corporation, who for forty years have had powers to supply the township but have not utilized them, have taken the matter in hand, and are now engaged in laying mains. The Golborne District Council some time ago approached the Company with a view to purchasing the works, but without result. The Company have since offered to reduce the price of gas from 3s. 9d. to 3s.; and the Leigh Corporation have stepped in with a similar offer. The Council asked the Company on Wednesday to include clauses in their Bill giving a fixity to the price of gas; but this was refused. The Leigh Corporation were also interviewed, and the Council met in the evening and decided to oppose the Company's Bill. The ratepayers' meeting followed, and the decision of the Local Authority was assented to by a large majority. The position of the township is peculiar from the fact that the South Lancashire Electric Supply Company have offered electric lighting at a low charge.

**Sales of Stocks and Shares.**—At the Mart, Tokenhouse Yard, on Monday last week, Mr. Alfred Richards sold, in accordance with instructions from the Directors, £20,000 of "A" ordinary stock of the Brighton and Hove General Gas Company, at prices ranging from £140 to £145 per £100 of stock; the average being £141 2s. 11d., which yields £4 19s. 2d. per cent. on the investment. On Tuesday, Mr. A. Morrison sold 20 £10 shares in the Airdrie Gas Company at £12 11s. each, and 10 at £12 10s. apiece.

**Carlisle Gas-Works Extensions.**—Saturday's "Carlisle Express" says: "The Gas-Works Committee of the Town Council held a meeting on Friday for the purpose of settling a question which had arisen in consequence of the action of Mr. Newton as to the carrying out by Mr. Corbet Woodall of the resolution of the Town Council requesting him to submit 'detailed estimates of such plant as he would recommend to be erected upon the present gas-works site to manufacture 600,000 cubic feet per diem.' The result of the meeting was that, after a good deal of heat had been evoked, a resolution was passed that Mr. Corbet Woodall carry out his own designs, and be solely responsible to the Corporation for the work done by him."

**Shrewsbury Gas Bill.**—Serious opposition to this Bill is not likely to be encountered, judging from an expression of opinion in the leading local newspaper. The "Shrewsbury Chronicle" says: "The Bill has more than a passing interest for the ratepayers of Shrewsbury. Were the town free of heavy loans and responsibilities, its presentation to Parliament would undoubtedly be a good reason for considering the desirability of purchasing the Gas Company's undertaking; but the financial position of Shrewsbury, as a borough, is such that it is very questionable whether the Town Council will entertain the idea. Apart from the question of present purchase, however, the Council will probably find it necessary to carefully consider all the provisions of the Bill, having in view the report presented to them a short time ago by a London firm of experts, and the possibility of a time coming when they may be in a position to seriously contemplate the acquirement of the business."

**Newtownards Gas-Works Extensions.**—Mr. A. D. Price, an Inspector of the Local Government Board for Ireland, recently held an inquiry in regard to an application by the Urban District Council of Newtownards for a loan of about £4000 for the extension of the gas-works and the improvement of the markets. Mr. Sharpe, who had examined the gas-works, said he calculated that in the last six years the consumption of gas in the town had gone up 37 per cent., and the number of consumers 17 per cent. The consumption of coal had increased about 31 per cent. in the same time. He found that the pressure had to be reduced owing to the inability of the retorts to produce sufficient gas, and cannel coal, at greater cost, had to be used. He estimated the proposed expenditure under seven heads—the cost of the coal-shed, additional retorts, retort-beds, boiler, station meter, roofing, and boundary wall. The total he estimated at £2291 7s. 6d., which he thought should be ample to effect the improvements. Some of the work should have been done two years ago. There was no opposition.




GAS FIRE LIST.

*NOVEL SHAPE.*

Gas Departments' Names printed free on 2nd page cover.

**Gas Share Speculation by a Town Clerk and Aldermen.**—At the time the Yeovil Corporation were negotiating for the purchase of the gas-works, a number of shares in the Gas Company came into the market. Eighty of them were purchased by the Town Clerk (Mr. H. B. Batten); and the transaction resulted in a gain of £1310—this being the difference between the market value of the shares and that set upon them at the arbitration. The matter came before the Town Council last Tuesday, when it was announced that the Town Clerk and three of the Aldermen acting with him in the matter had made the town a present of the sum mentioned. The Mayor remarked that the whole transaction was entirely out of order; and it lay with any member of the Council to refuse to accept the gift. The money was, however, accepted, and the Town Clerk was thanked for his action in the matter.

**Sea Water for Streets.**—In a recent issue, the "Thanet Times" devoted an article to the above subject, which had been brought forward several times in the controversy over the water question in Margate. It had been asserted that so far from sea water being detrimental to roads, it was actually beneficial. The writer, however, quotes largely from "Notes on Water Supply," by Mr. J. T. Rodda, of Eastbourne, to prove the contrary. The general effect of this gentleman's observations is decidedly against the use of sea water for municipal purposes, and he believes all engineers who may have selected and visited the most popular seaside resorts during the hottest months of the year for the express purpose of deciding which water is best for sprinkling the roads, will not hesitate to give the preference to fresh, not only in regard to the health of visitors and the general sanitary condition of the town, but also to the comfort of the inhabitants.

**Tees Valley Water Board.**—The accounts of this Board for the half year ending Aug 13, 1900, together with the report of the Auditors, have been presented to the Corporations of Stockton, Middlesbrough, and Thornaby. They show the capital expenditure for this period to have been £10,458; bringing the total cost of the undertaking up to £1,906,013. Of the capital expenditure during the half year, £1389 was for the extension of mains. A sum of £11,887 was received on capital account—the total to date being £1,901,081, or £4932 less than the amount expended; but a precept was issued, payable on the 29th of September, for £3333 on account of parliamentary costs, 1899. The revenue account shows the income to have been £47,018; being an increase of £770 compared with the preceding six months, and of £3992 compared with the half year ending Aug. 13, 1899. The expenditure on revenue account amounted to £8692; being £329 more than in the preceding half year, and £575 more than in the six months ending Aug. 13, 1899. The balance carried to net revenue account is £38,326, against £37,855 and £34,909 in the two preceding half years. The net revenue account is debited with several payments for interest, and is credited with that allowed by the bank. After being dealt with in this manner, there remains a balance of £56,424, including the sum of £18,188 brought forward. Of this amount, £36,000 was paid to the Corporations during the half year; leaving £20,424 to be carried forward, £15,000 of which has since been paid to the respective Corporations.

**Paris Gas Question.**—At the close of the article on this subject in the "JOURNAL" for the 1st inst., it was mentioned that some further proposals which had been submitted to the Municipal Council for securing a reduction in the price of gas would be considered at a special meeting to be held early this month. This was done a few days ago, and a stormy debate took place without leading to any definite result. The Prefect of the Seine will probably be again asked to formulate some opinion on this knotty question, which will not come before the Council till the end of the month.

**Gas Poisoning Case at Eastbourne.**—The death of a Miss Eva Slatter was the subject of a Coroner's inquiry on Monday last week at Eastbourne. Deceased retired to bed in her usual health, locking her door. Next morning the servant, Mrs. Chapman, failing to rouse her, procured a ladder, and by it gained admission by the casement. She found the room full of gas, which was escaping from a bracket near the window. It was supposed that, after extinguishing the light, deceased partially raised the venetian blind, the cord of which caught against, and turned on, the gas-tap—a circumstance unnoticed by Miss Slatter, who was discovered dead in bed. A verdict of "Accidental death by gas poisoning" was returned.

**Mr. Gilbert Little on American v. British Machinery.**—Lord Rosebery, Mr. Chamberlain, and numerous other public men, including a large number of the Presidents of Technical Institutions, have written letters to Mr. Gilbert Little with reference to his recent letter in the "Birmingham Post" on the undue prominence given in English newspapers to American labour-saving devices being superior to British (*ante*, p. 103). Nearly all the writers endorse Mr. Little's contention with regard to automatic appliances being quite as efficient and as easily obtainable in England as in America. Our readers will remember that Mr. Little was particularly precise and emphatic in his claims regarding the superiority of automatic appliances at English collieries, flour mills, breweries, and iron, steel, and gas works.

**Bordeaux Gas Company.**—The profit made by this Company in the past financial year was 754,286 frs. From this sum, 37,714 frs. were placed to the reserve, 60,000 frs. were set aside for the redemption of the shares, and interest at the rate of 5 per cent. came to 150,000 frs.; making a total of 247,714 frs. Out of the remaining 506,572 frs., 50,657 frs. were paid to the Directors, and there was left a balance of 455,915 frs. Of this the shareholders took 300,000 frs., and one-third of this amount went to the holders of founders' shares; leaving 55,915 frs. (£2237) to be carried forward. The dividend declared at the annual meeting was 75 frs. per share (500 frs.)—5 frs. less than for the year 1898-9. The output of gas was 25,509,666 cubic metres, or about 900 million cubic feet—an increase of 427,552 cubic metres on the consumption in the previous year; but the revenue was 13,379 frs. less, owing to the reduction made by the Company in the price charged to large consumers, in order to meet the competition of the electric light, which, notwithstanding the terms of the contract, the Municipality of Bordeaux have allowed to be introduced. For this breach of the agreement, the Company are claiming damages.

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**Defective Water Supply by a Local Authority.**—A novel claim has been made on the Chard Town Council by one of the principal water consumers in the town. The gentleman in question has for many months past, in common with a large number of the other burgesses, suffered from a deficiency in the town supply, and he has sent to the Council an account for the labour of his employees in fetching, carrying, and pumping water to his premises. He contends that the Council, as the local governing authority, are bound to furnish him with an efficient supply of water. For the present the Council have allowed the account to remain in abeyance; but it is believed that the matter will be pressed, and that this will be made more or less a test case.

**Halifax Water-Works Department.**—The work done in the Halifax Water-Works Department during 1900 included the following: Total length of new mains laid, 71,164 yards; total mains repaired and reinstated, 1689 yards; number of valves fixed, 114; number of hydrants fixed, 114; houses and shops supplied, 598; baths supplied, 169; water-closets supplied, 294; houses, workshops, mills, &c., visited by inspectors, 25,893; fittings found defective—taps 7177, water-closets 121, burst pipes 645; complaints of all descriptions taken in at the office, 13,397; times water turned off for repairs by authorized plumbers, 2560; meter dirt boxes cleaned out, 1556; hydrants inspected and mains washed out, 6734; hydrants found in good order, 6075; hydrants found defective, 59; miscellaneous, 300.

**Carlisle Gas Workers' Agitation.**—At a fully-attended meeting of the men employed by the Gas Committee of the Carlisle Corporation, held last Wednesday, the present position regarding their application for an increase of wages was discussed. Mr. Lynas, Secretary of the North-Eastern District of the National Union of Gas Workers and General Labourers, stated that he had, according to their instruction, forwarded an application for an advance of wages and extra payment for Sunday labour to the Manager (Mr. C. B. Newton), who had replied that he was willing to meet the men themselves relative to the matter. In the course of negotiations, Mr. Newton stated that he was acting according to instructions received from the Committee. The meeting resolved that Mr. Lynas be directed to write to the Chairman of the Committee, requesting them to receive a deputation of the men, together with Mr. Lynas.

**Criminal Trapped in Gas-Works.**—Though gas-works are regarded by many people as unmitigated nuisances, they can nevertheless lay claim to be at times of public service apart from furnishing an element of light and warmth to the community. The therapeutic effect of the odours prevailing in these establishments in certain affections of the respiratory organs of children has been recognized; but it is only within the last few days that gas-works have assisted in trapping a criminal trying to escape from his pursuers. Last Thursday evening, London was shocked by the news of a dastardly crime committed in a third-class carriage of the South-Western Railway Company about midday, resulting in the death of one victim and the wounding of another. The details of the crime need not be given here. All we have to do is to record the fact that on the train arriving at Vauxhall station the author managed to get clear of the platform before a chase could be set up. On leaving the station, he made for the bridge over the river; but as the approach was blocked he could not elude his pursuers in that direction. He thereupon turned and dashed into the works of the South Metropolitan Gas Company, which proved a veritable man-trap. The following is the account given by "The Times" of what followed: "The doorkeeper was almost knocked down by the stranger, who fled across a small bridge over a creek in the yard and, running halfway round the yard, ultimately entered a tunnel leading to No. 4 retort-house. Here, in a coke-truck, he secreted himself. The crowd of pursuers had before this reached the gas-works, and the Engineer in charge at once gave orders for the gates leading into Wandsworth Road—the only other exit from the works—to be closed. This was done, and the police were informed where the man had been seen to hide himself. The tunnel is a dark one, and, while a careful watch was set to prevent the man from attempting to leave it, lanterns were obtained and a number of officers approached the entrance. At first the man would not come out, but, after he had been confined in the tunnel, which was extremely hot, for about a quarter of an hour, he exclaimed, in answer to a demand that he should give himself up: 'All right; I'll come quietly,' and surrendered to a constable without the sign of a struggle."

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The European Gas Company have declared an interim dividend of 8s. per share, free of income-tax.

The Elland Gas Bill is to encounter the combined opposition of the Elland, Greetland, and Stainland District Councils.

The Driffield District Council have decided to build a new gasholder; the present storage accommodation being insufficient.

The Cleethorpes Gas Company have placed orders with Messrs. R. Dempster and Sons, Limited, of Elland, for three 30-feet square purifiers, with superstructure, roof, oxide elevator, conveyor, &c., and for a scrubber-washer, &c.

A Local Government Board inquiry was held at Battle last Tuesday respecting an application by the District Council for sanction to the borrowing of £5000 for water supply works. Some little opposition was shown on the ground of expense.

At the last monthly meeting of the Heywood Town Council, the Gas Committee recommended an increase in the salary of the Gas Engineer (Mr. W. Whatmough); considering him to be a good, conscientious Manager who devoted the whole of his time and care to the works. The recommendation was adopted.

In addition to the order for the Walsall Gas-Works, mentioned elsewhere, West's Gas Improvement Company, Limited, have recently received contracts for complete installations of their compressed air stoking machinery for the Basford Gas-Works, Nottingham (second installation); and they have in course of construction this type of machinery for the Greenock, Halifax, Oldham, and Southport Gas-Works, and manual stoking machinery for the Chester and Ramsgate Gas-Works.


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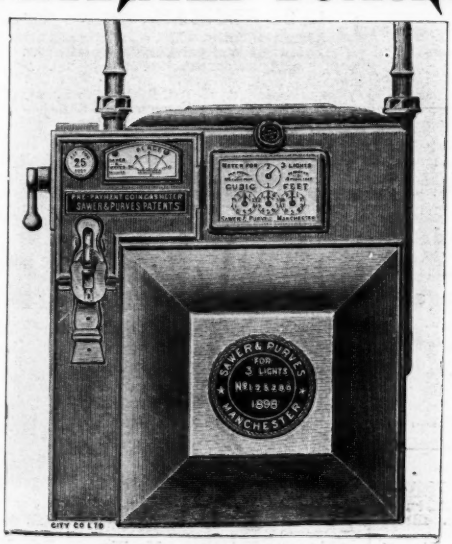
(BRANCH OF METERS LIMITED),

Telegraphic Address: "SAWER, MANCHESTER."
National Telephone: 3289 MANCHESTER.

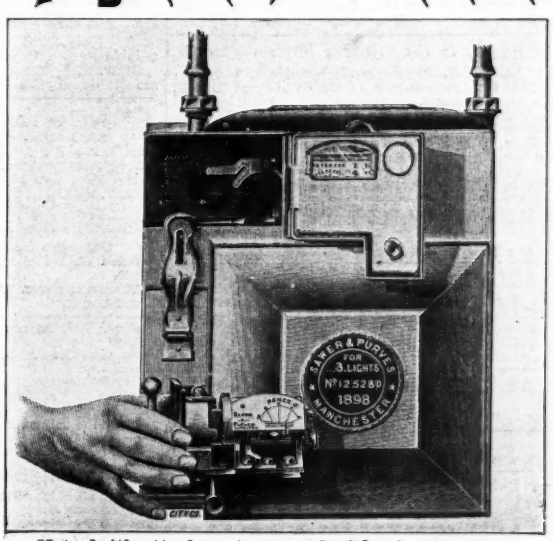
NELSON METER WORKS, MILES PLATTING,
**MANCHESTER.**

**Makers of Meters fitted with**

# PATENTED Detachable Prepayment Attachment.




Meter in working position.




Meter with attachment removed without uncoupling.

In view of the Bill now being promoted by the Ilkeston Corporation and the Heanor Urban District Council, by which powers are sought to utilize the water in the Meerbrook Sough for the supply of those towns, the Wirksworth Urban District Council have engaged Mr. Percy Griffith, Assoc.M.Inst.C.E., F.G.S., of Westminster, to advise them with reference to supplementing their present water supply from this source. The Sough drains the disused lead workings near Wirksworth, and discharges into the Derwent three miles east of the town.

Mr. W. Edgar, of Hammersmith, has made a commencement with the work of bringing the lighting of the London parks up to date. Twenty incandescent gas-lights were put in operation in the Green Park for the first time, as a trial, on the evening of the 9th inst., and now are nightly admired by pedestrians using the main artery of the park, leading from the Junior Constitutional Club to Buckingham Palace. No. 4 Kern burners are used, enclosed in globe lanterns, fitted with Edgar's patent roller flap; the burners being lighted by the Foulger-Glover torch, of which Mr. Edgar is one of the licensed makers. By this means the pilot-light is abolished, and an economical, brilliant, and lasting light is obtained. The effect is excellent, and a great improvement in the lighting has been effected. Mr. Edgar fitted St. James's Park some time back with the "Westminster" pattern lanterns and incandescent burners. His present contract is for fitting all the rest of the lamps in Hyde Park in a similar manner to those lighted by him for the first time on the 9th inst.; the work already done, and the system of lighting the burners by the above-named torch, having been inspected and approved by Her Majesty's Commissioners.

## NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

*No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.*

**TERMS OF SUBSCRIPTION to the "JOURNAL."**

**One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.**

*Payable in Advance.* If credit is taken, the charge is 25s. a year.

**Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1901, are reminded that this should be done at once.**

**COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.**

**Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.**

**All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.**

**Telegraphic Address: "GASKING, LONDON." Telephone Number: Holborn 121.**


**GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.**

**OXIDE OF IRON.**

**O'NEILL'S Oxide has a larger annual** sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications *re* Oxide to the Company as above.

**WINKELMANN'S**

**"VOLCANIC" FIRE CEMENT.**

Resists 4500° Fahr. Best for use in GAS-WORKS.

ANDREW STEPHENSON,
182, Palmerston Buildings,
Old Broad Street,
"Volcanism, London." London, E.C.

**NEW GAS PLANT CEMENT.**

**JOHN E. WILLIAMS AND CO.,**
VICTORIA PAINT WORKS,
MANCHESTER.

For all Joints in connection with Oil Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

**BROTHERTON & CO.**

Offices: Commercial Buildings, LEEDS. Correspondence invited.

**PATENTS FOR INVENTIONS.**

Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

**SULPHURIC ACID for Sale.**

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

**PORTER & CO., Gowts Bridge Works,** LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."
[For Illustrated Advertisement, see Jan. 1, p. 54.]

**AMMONIACAL LIQUOR wanted.**

BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

**SADLER & CO., Ltd., Middlesbrough,** Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

**GAS TAR wanted.**

BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

**HYDRATED OXIDE OF IRON.**

**PREPARED from Pure Iron.**

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

**J. & J. BRADDOCK (Branch of Meters** Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

**RICHARDS & CO., Practical Retort** Setters. Retort-Settings of every description Re-Set. Estimates on application.
Office: No. 6, Denton Street, Radford, NOTTINGHAM.

**ADVERTISER (age 31, and Married)** seeks re-engagement as MANAGER of Gas-Works, making from 10 to 20 million cubic feet per annum. Highest References.
Address No. 3634, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WATER ANALYSIS.**

**CHEMIST, having had considerable** experience in above, seeks RESPONSIBLE POST. Moderate Salary for a permanency.
Address H. R. D., care of Wm. Dawson & Sons, 23, NORTHUMBERLAND AVENUE, W.C.

**WANTED, Draughtsman, used to Gas-** holders and Constructional Ironwork.
CLAYTON, SON, & CO., LIMITED, Gasholder and Boiler Works, Hunslet, LEEDS.

**WANTED, a thoroughly efficient Man** to take charge of Photometer and Test-Room.
Apply to the SCOTT-SNELL SELF-INTENSIFYING GAS-LAMP COMPANY, LIMITED, 51, Victoria Street, WESTMINSTER.

**WANTED, a Working Foreman at the** Gas-Works, Newport, Salop. House and Garden, Gas, and Coal free. Married Man preferred.
Apply, stating Age, Wages required, and References, to Mr. HEANE, Secretary, Newport, SALOP.

**WANTED, Main and Service Layer** (Spigot and Socket Pipes). Must be a steady, reliable Man. Wages 30s. per week.
Apply, with Testimonial from present Employer, to the SECRETARY, Gas and Water Company, ALDERSHOT.

**WANTED, by a Country Gas Company,** a BOOK-KEEPER, with practical knowledge of Gas-Fitting, &c. To live on the Premises; Gas free.
Apply, stating Age, Experience, and Salary required, to No. 3635, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**CHEAP Fuel, Cheap Light, Hydrogen** Gas from Exhaust Steam (Patent 10,108, 1899). Wanted AGENTS and FINANCIAL AID in making Plant.
Address SAMUEL POINTON, 201, Plymouth Grove, MANCHESTER.

**A LONDON Firm whose Representatives** visit the Gas Companies throughout the United Kingdom are prepared to accept an AGENCY FOR THE SALE OF SPECIALITIES, &c., to Gas Companies and Corporations, on Commission.
Apply, by letter, to No. 3630, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**GAS-TUBE TRADE.**

**OLD-ESTABLISHED Firm require** AGENT to call on Gas-Works. Must be well known to Managers, and capable of securing Orders. Liberal Commission given.
Apply, by letter, to No. 3633, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**OXIDE OF IRON OF FINEST QUALITY.**

**BALE'S Special Fire Cement should be** used to keep Retorts, Furnaces, &c., in good repair during the heavy Winter Work.
Send for full Particulars to
BALE & CO., 120 & 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."
Telephone "277 HOLBORN."

**SULPHATE OF AMMONIA SATURATORS.**

**JOSEPH TAYLOR & CO., Chemical** Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

**WORKING MANAGER.**

**WANTED, to superintend laying of** Mains, erection of Works, and subsequently to take charge of same, a WORKING MANAGER for Freshwater, Isle of Wight.
Apply, with Reference, stating Salary required, Age, and Family, to WILLIAM HALLIDAY, 40, High Street, COWES.

**HOLYHEAD AND NORTH WALES GAS AND WATER CORPORATION, LIMITED.**

**WANTED, a Working Manager for the** Llanrwst Gas-Works.
Applications in own Handwriting, giving Age and Experience, and enclosing Testimonials, to be sent to G. E. SAVILLE, Gas Engineer, PENMAENMAWR.

**YARD FOREMAN.**

**WANTED, a steady, capable Working** Man, to act as FOREMAN OF LABOURERS employed on Yard Work. Age about, or under, 35. Must have been engaged on Gas-Works, and be able to keep his Men's time.
Apply, by letter, stating Experience, Wages, &c., to the SECRETARY, Gas and Water Company, ALDERSHOT.

**DRAUGHTSMAN wanted for En-**gineers' Works. Must be accurate and experienced in the details of General Engineering, and a knowledge of the construction of Gas-Works Plant is desirable.
Apply, stating Age, Qualifications, and Salary required, to WEST'S GAS IMPROVEMENT COMPANY, LTD., Albion Iron-Works, Miles Platting, MANCHESTER.

**WANTED, an Engineer and Manager** of good executive ability, with experience of Water-Works, Pumping-Engines, Pumps, Wells, and distribution of Water to take the management of the Works of the Sunderland and South Shields Water Company.
Applicants to state Age, Employment (past and present), and Salary expected, and to forward *copies* of not more than three recent Testimonials.
Apply to SECRETARY, 16, Fawcett Street, SUNDERLAND.

**WANTED, an energetic and capable** MAN, to take CARE OF, AND MANAGE, COKE-OVENS, where Bye-Products are collected. He must have had experience with Fire-Brick Work and the Lining of Ovens. He must also thoroughly understand the Manufacture of Sulphate of Ammonia and Benzol, and have a fair knowledge of General Engineering. The Plant will be entirely placed under his charge; and he will be responsible for the results obtained. The applicant will be expected to superintend the tests for Waste, &c., that are made daily.
Salary £250 a Year, and a Bonus on the result.
Only those who have had actual experience, and can give undeniable References, need expect a reply to the application.
Address No. 3631, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WANTED, a good Main and Service** LAYER. One accustomed to Meter and Stove Fixing (Iron and Compo.). Constant employment.
Applicants to state, by letter, Age and Wages required, and enclose recent Testimonial, to No. 3636, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS TEST-HOLDERS.

**WANTED, two good, second-hand Test-**HOLDERS; 5 or 10 feet capacity.
Address No. 3632, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**FOR SALE - A Second-hand 300-Light** DRY GAS-METER (1897 make). Very little used, and in good condition. By T. Glover & Co.
T. M. DAFFERN, 20, High Street, COVENTRY.

**THE Moreton-in-Marsh Gas and Coke** Company, Limited, have several Barrels of TAR and AMMONIA WATER to dispose of weekly.
Write, with Offer, to the SECRETARY, Mr. A. W. Drury.

**GAS PLANT for Sale—I can always offer** NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY Gas Engineer, Thornhill, DEWSBURY.

**A SET of Four Second-Hand Purifiers** wanted, with an area of not less than 190 feet each.
Offers, with full Particulars, to be sent in the first instance to No. 3603, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**TO BE LET on Hire—**
PULSOMETER, Size No. 5, with 4-in. suction and 3-in. delivery. Steam-Pipe ¾ in. diameter. Discharge 10,000 Gallons per hour.

**TO BE SOLD—**
GASHOLDER, 30 ft. diameter by 10 ft. deep, with Five Columns, equal to new, only having worked Four or Five Years.
EXHAUSTER for 63,000 feet per hour, with Steam-Engine, by Gwynne. In excellent condition. Replaced by 200,000 feet.
Write J. WRIGHT, Bridge House, BLACKFRIARS BRIDGE, E.C.

**ISLE OF THANET GAS COMPANY, MARGATE.**

**THE Directors of the above Company** are prepared to receive TENDERS for the supply of the following CAST-IRON MAINS:—
550 Yards of 8-inch CAST-IRON SOCKET and SPIGOT PIPES.
850 yards of 6-inch CAST-IRON SOCKET and SPIGOT PIPES.
1000 yards of 4-inch CAST-IRON SOCKET and SPIGOT PIPES.
Also SPECIAL CASTINGS.
Further Particulars as to time of Delivery, &c., may be obtained on application to the Engineer, Mr. James Dougall.
Tenders, endorsed "Cast-Iron Pipes," to be addressed to the Chairman, and to be delivered at the Offices of the Company not later than Jan. 31, 1901.
By order,
THOS. C. FULLER,
Secretary.
Offices: The Dane, Margate,
Jan. 19, 1901.

**CITY OF LINCOLN.**
CORPORATION WATER-WORKS.

TO WELL SINKERS.

**THE Water-Works Committee of the** Corporation of Lincoln invite TENDERS for the construction of a DEEP BORING, to be carried out at the Corporation Water-Works, Boultham, near Lincoln, for the purpose of obtaining a supply of Water from the Bunter Beds of the New Red Sandstone.
Copies of the Specification, Section, and Forms of Tender, together with all available Information, can be obtained at the Offices of the Engineer, Mr. Percy Griffith, Assoc.M.Inst.C.E., F.G.S., 54, Parliament Street, Westminster, or of the Water-Works Engineer, Mr. John H. Teague, Corporation Offices, Lincoln, upon payment of a sum of Five Pounds, which will be returned on the receipt of a *bonâ-fide* Tender.
Tenders must be delivered in the proper sealed Envelopes, endorsed "Tender for New Boring," at the Office of the Deputy Town Clerk, 5 and 6, Bank Street, Lincoln, not later than Twelve noon on Monday, March 4, 1901.
The Committee do not bind themselves to accept the lowest or any Tender.
By order,
W. T. PAGE, Jun.,
Deputy Town Clerk.
Lincoln, Jan. 16, 1901.

**CORPORATION OF BLACKPOOL.**

**THE Gas Committee are prepared to** receive TENDERS for the supply and erection of a STEEL ANNULAR CONDENSER, and TUBULAR WATER CONDENSER, also one PELOUZE TAR-EXTRACTOR capable of dealing with 2 millions per day.
Specification and Plans may be seen at the Office of the undersigned.
Tenders, endorsed, must be sent to the Chairman by Saturday, the 26th of January.
(Signed) JOHN CHEW,
Gas Engineer.
Corporation Gas-Works, Princess Street,
Blackpool, Jan. 16, 1901.

**TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.**

**NOTICE is Hereby Given, that it is the** intention of the Directors of the above-named Company to offer for SALE BY AUCTION, at the Mart, Tokenhouse Yard, in the City of London, on Tuesday, the 19th day of February, 1901, at Two o'clock in the afternoon precisely, £9900 (Nine Thousand Nine Hundred Pounds) of FOUR PER CENT. PERPETUAL DEBENTURE STOCK, being the balance of the amount authorized to be raised by the issue of Debenture Stock by Resolution passed at an Extraordinary General Meeting of the Proprietors held on the 24th day of February, 1900, in pursuance of the powers of the Tottenham and Edmonton Gas Act, 1898.
Printed Particulars and Conditions of Sale may be had at the Offices of the Company; also of the Auctioneer, Alfred Richards, 18, Finsbury Circus, London, E.C.
By order,
JAMES RANDALL,
Secretary.
Offices of the Company: Willoughby Lane,
Tottenham, Jan. 18, 1901.

**BRENTFORD GAS COMPANY.**

SALE BY TENDER OF
£46,875 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

IN PURSUANCE OF THE BRENTFORD GAS ORDER, 1881.

**NOTICE is Hereby Given, that it is the** intention of the Directors of this Company to SELL BY TENDER £46,875 FOUR PER CENT. PERPETUAL DEBENTURE STOCK of the Company, to be paid up in full on or before the 21st day of February next, such Stock being the amount authorized to be raised by Resolution passed at an Extraordinary Meeting of Proprietors held on the 10th day of August, 1900, under the powers of the above-mentioned Order.
Particulars and Conditions of Tender may be obtained on application at this Office; and sealed Tenders must be sent in not later than Twelve o'clock (noon) on Thursday, the 31st of January, 1901.
By order,
WILLIAM MANN,
Secretary.
Office: Brentford Gas Company,
Brentford, Jan. 5, 1901.

**SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.**

**MR. ALFRED RICHARDS begs to** notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.
He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.
Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
**SOUTHEND WATER-WORKS COMPANY.**

NEW ISSUE OF 500 £10 NEW ORDINARY SHARES.

**MR. ALFRED RICHARDS will Sell the** ABOVE BY AUCTION, at the Mart, E.C., on Monday, Feb. 4, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
**KINGSTON-UPON-THAMES GAS COMPANY.**

**SUDLOW HERRICK AND SONS are** instructed to SELL BY AUCTION, at the Sun Hotel, Kingston, on Thursday, Jan. 24, 1901, at Three o'clock precisely, in Lots of £100 and £50 each,

£10,000
NEW CONSOLIDATED ORDINARY STOCK
IN THE
KINGSTON-UPON-THAMES GAS COMPANY.

Particulars and Conditions of Sale may be obtained of the SECRETARY of the Company at the Offices, Church Street, KINGSTON; at the Place of Sale; and of the AUCTIONEERS, 90, Eden Street, KINGSTON.

**SOUTH METROPOLITAN GAS COMPANY.**

**NOTICE is Hereby Given, that the** ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Cannon Street Hotel, in the City of London, on Wednesday, the 13th day of February next, at Two o'clock in the afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st of December last, to declare a Dividend for the same period, and to elect two Directors and One Auditor in the place of those retiring by rotation.
The TRANSFER BOOKS WILL BE CLOSED from the 30th day of January until after the Meeting.
By order,
FRANK BUSH,
Secretary.
Offices: 709A, Old Kent Road, S.E.,
Jan. 19, 1901.

*Now Ready. Net Price: Cloth Bound, 12s. 6d.; Morocco Gilt, 18s.*

## GAS COMPANIES' BOOK-KEEPING.

**A Practical Treatise on the Keeping of Gas Companies' Accounts.**

By
**JOHN HENRY BREARLEY & BENJAMIN TAYLOR,**
OF LONGWOOD.

**The only complete Treatise on Gas Companies' Book-Keeping ever published.**

This book will be found invaluable to those desirous of obtaining a thorough grasp of Gas Companies' Book-Keeping and Accountancy.
A complete set of Transactions are dealt with; the same being entered into the various Books, and posted into the Ledgers. A Model Balance-Sheet is prepared from the set of transactions and postings.
Forms and subsidiary books are illustrated and described. The linking together of the various books is shown at a glance by means of a Chart.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

## COKE-BREAKERS,

**PRICES REDUCED.**

**(THOMAS & SOMERVILLE'S PATENT)**
**With Elevators and Conveyors worked by Steam or Gas Engine.**

**GEORGE WALLER & CO.,**
**165, QUEEN VICTORIA STREET, E.C.;**
*And at STROUD, GLOUCESTERSHIRE.*

## UNEQUALLED.

**Gas Companies are solicited to try Samples of the**

## MIRFIELD BLACK BED GAS COAL.

***Prices and Analysis on application.***

**MIRFIELD (GAS-COAL) COLLIERY COMPY.**
**RAVENSTHORPE, NEAR DEWSBURY.**

## HYDRAULIC BLOWER

**For blowing Air into Gas Purifiers for the purpose of**

## REVIVIFYING THE FOULED OXIDE.

Full Particulars on application.

**LUXWERKE LUDWIGSHAFEN AM RHEIN.**

## THE WIGAN COAL & IRON CO., LIMTD.,

**Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.**

**Midland and West of England District Office: 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.**
**Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.**

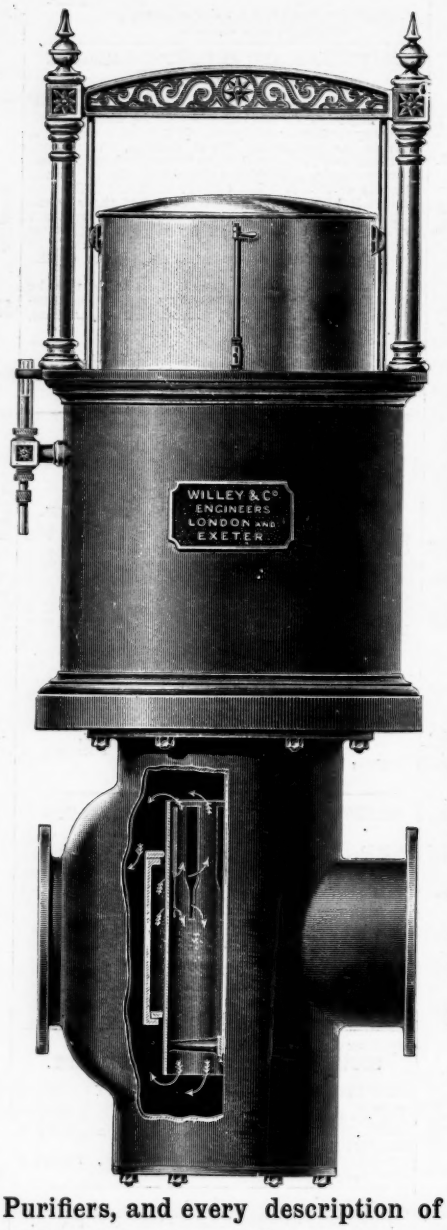
**London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.**
**Telegraphic Address: "PARKER, LONDON."**

# IMPROVED PATENT
# *GAS GOVERNOR.*

*TESTIMONIAL FROM THE*

**PLYMOUTH & STONEHOUSE GASLIGHT & COKE CO.**

"Our Engineer has reported to the Directors that the Patent Equilibrium Station Governor which you fixed here last year, replacing one of another make, is giving every satisfaction, and maintains an absolutely regular outlet pressure under most trying conditions. We consider the open-ended Cylindrical Valve perfect, and a great improvement on the usual complicated construction of Equilibrium Governors, which are generally only balanced in one position of their range."




The Inlet Pressure having absolutely no effect on the open-ended cylindrical Valve, the pressure is maintained constant at the outlet **UNDER ANY CHANGE OF PRESSURE OR DRAUGHT**, and dispenses with the usual complicated balancing arrangements.

Provided with a most **SIMPLE** and **CONVENIENT METHOD** of **WATER LOADING** and **WITHDRAWAL** without syphons or other complications, or with weights to adjust pressure as desired.

**Manufacturers of Gasholders, Purifiers, and every description of Gas Plant of any capacity. Station Meters, Wet and Dry Consumers' Meters, Prepayment Meters, Gas Apparatus and Gas Fittings. Also Bridges, Roofs, Columns, Girders, and Structural Iron and Steel Work of all kinds. All Sizes of Livesey Washers kept in Stock.**

# WILLEY & CO.,

## ENGINEERS, IRONFOUNDERS, & CONTRACTORS.

CHIEF OFFICES AND WORKS } **ST. THOMAS, EXETER.** Telegrams: "WILLEY, EXETER." Telephone: 132 and 263.

**METER-WORKS—32a, Hertford Road, De Beauvoir Town, LONDON, N.; and James Street, EXETER.**
**OFFICES & DEPOTS—LONDON: 18, Adam Street, Adelphi; MANCHESTER: Victoria Buildings, PLYMOUTH, DEVONPORT, SWANSEA, & NEWPORT.**

## HEATHCOTE GAS COAL.

**Rich in Illuminating Power and Yield of Gas.**

**Above the Average in Weight and Quality of Coke.**

**Maintains a High Standard in Residuals.**

## THE GRASSMOOR CO., LD.

**CHESTERFIELD.**

## HARDMAN & HOLDEN, LD.

ESTABLISHED 1820.

## SULPHURIC ACID.

GUARANTEED absolutely free from Arsenic and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.

Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.

Head Office: Miles Platting, MANCHESTER.

**Inquiries Solicited.**

## THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

**90, CANNON STREET, E.C.**

## HOLMSIDE GAS COALS.

**Present Daily Produce over 5000 Tons.**

*Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation*

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power 16 7/10 Stand. Sperm Candl.
Coke (of good & pure quality) 18¾ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

### SOUTH MOOR PELTON GAS COALS.

**Present Daily Produce available 3000 Tons.**

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

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**DISPENSE WITH CANNEL COAL and INCREASE YOUR ILLUMINATING POWER by using the**

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**The Cheapest and Best in the Market.**

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**Highest Results in Gas, & Excellent Coke.**

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LIMITED,

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## JAMES OAKES & CO.

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Manufacture and keep in Stock at their Works (also large stock in London)

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NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

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**BURNERS**

Welsbach Pattern

per **7/6** Doz.

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## THORNLEY GAS COALS

**WORKED BY THE**

## WEARDALE IRON & COAL CO., LD.

**OUT OF THEIR**

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**Analysis made by Messrs. J. & H. S. PATTINSON.**

Yield of Gas per Ton . . 10,500 Cub. Ft.
Illuminating Power . . . 16·9 Candles.
Coke (of good quality) . . 67·5 per Cent.
Sulphur . . . . . 0·58 „
Ash . . . . . 2·73 „

**For Price, &c., apply to the**

**WEARDALE IRON & COAL CO., LD.**

**QUAYSIDE, NEWCASTLE-ON-TYNE.**

## BOLDON GAS COALS.

Yield of Gas per Ton. . 10,500 Cubic Feet.
Illuminating Power . . 16·9 Candles.
Coke . . . . . 66·7 Coke.
Sulphur . . . . . 0·86 Sulphur.
Ash . . . . . 2·04 Ash.

As per Analysis by

**Mr. JOHN PATTINSON, F.I.C., F.C.S.**

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THE HARTON COAL CO., LTD.,

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**Full Particulars on application to the Patentees**

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Coke per ton . . . . . 1,301·83 lbs.

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Yield of Gas per ton . . . . 10,500 cub. ft.
Illuminating Power . . . . 17·8 candles.
Coke . . . . . 70 per cent.

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Yield of Gas per ton . . . . 10,500 cub. ft.
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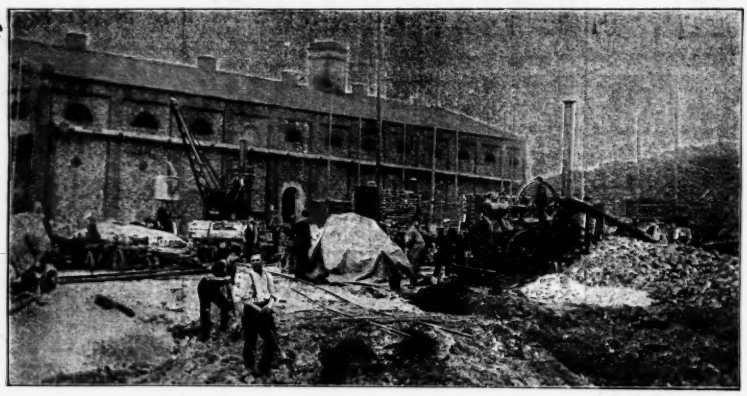

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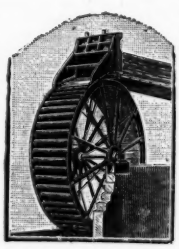

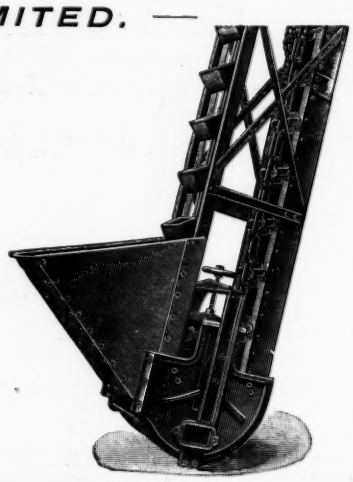

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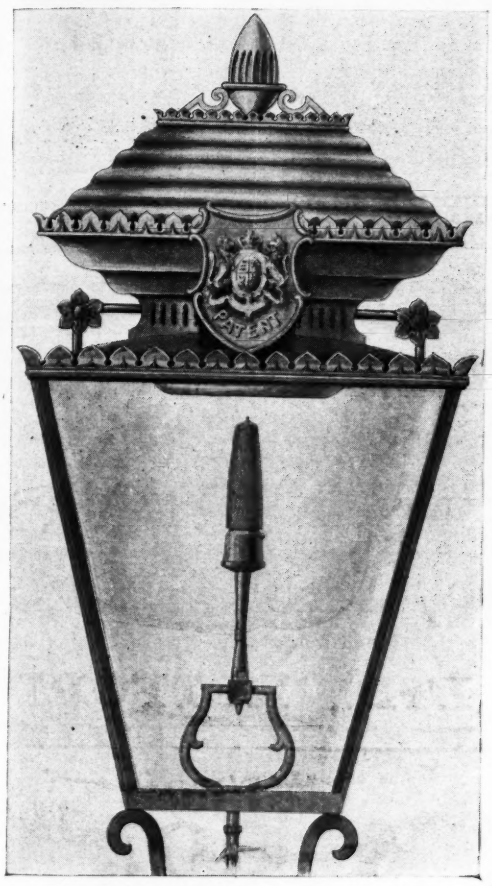
# SELF-INTENSIFYING LAMP.




SIZE NORMAL.

**Automatic Action.**

**No Complex Mechanism.**

**"Power" Free of Cost.**

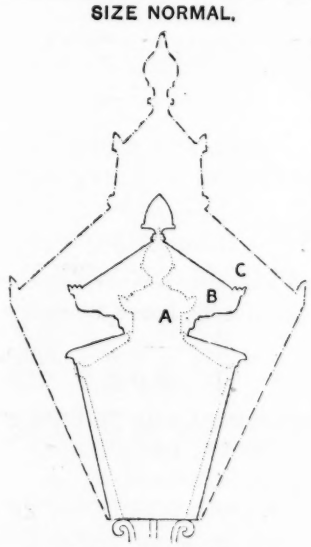
## INTENSIFIED LIGHT

**WITHOUT** Compressing Plant, Special Gas-Service, Water Bill, Gas-Engine or other Pumping Appliances, tearing up of Roadways, or interference with existing Service.

The **SCOTT-SNELL LAMP** may be set to give any pressure from 4 inches to 36 inches of Water; 8 inches to 10 inches is usually preferred.

**300**-*CANDLE POWER OBTAINED FROM A SINGLE BURNER.*

**Lanterns supplied with Single, Duplex, or Cluster of Burners.**




SCALE DIAGRAM.
A. Ordinary 16 inch Street Lamp.
B. Scott-Snell Self-Intensifying Lamp.
C. Ordinary Refuge Lamp.

## HIGH-PRESSURE LIGHTING HAS COME TO STAY.

Orders for Trial Lamps will, as far as possible, be executed in rotation.

The Lamps are being made by Automatic Machinery, similar parts interchangeable, minimum of hand labour.

THE LAMPS MAY BE INSPECTED AT ANY TIME BY APPOINTMENT.

**THE SCOTT-SNELL SELF-INTENSIFYING GAS-LAMP COMPANY, LTD.**

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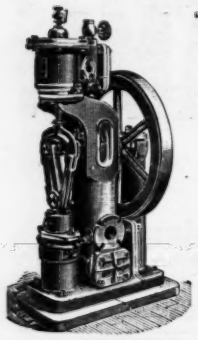


Fig. 705. "SINGLE RAM" STEAM-PUMP.

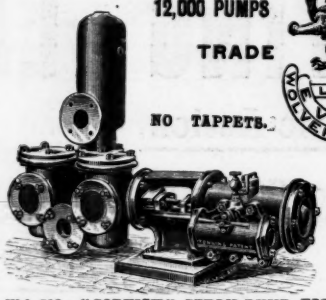


Fig. 698. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

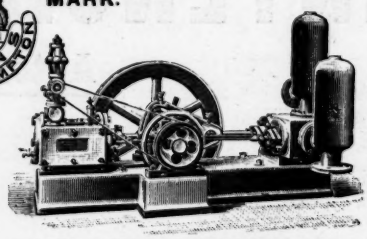


Fig. 688. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

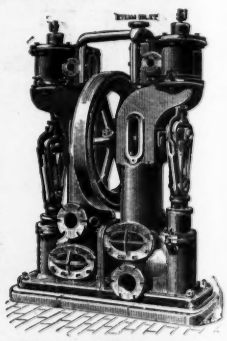


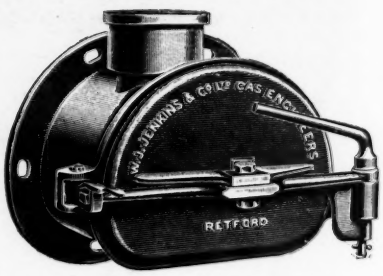
Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

# MOUTHPIECES

WITH SELF-SEALING LIDS FOR HORIZONTAL AND INCLINED RETORTS.

SOLE MAKERS OF

## THE "DE BROUWER" PATENT COKE-CONVEYOR.

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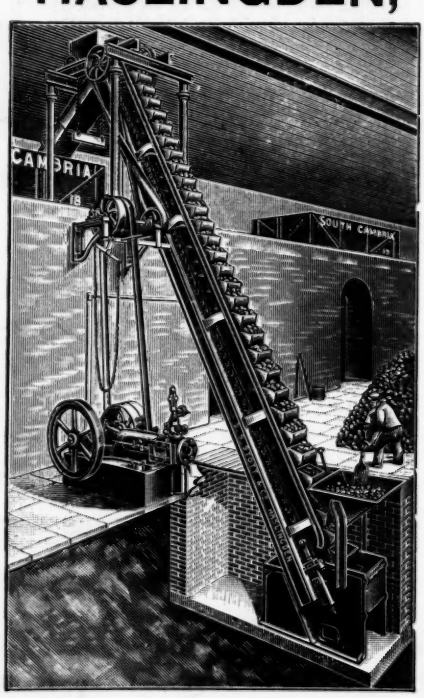

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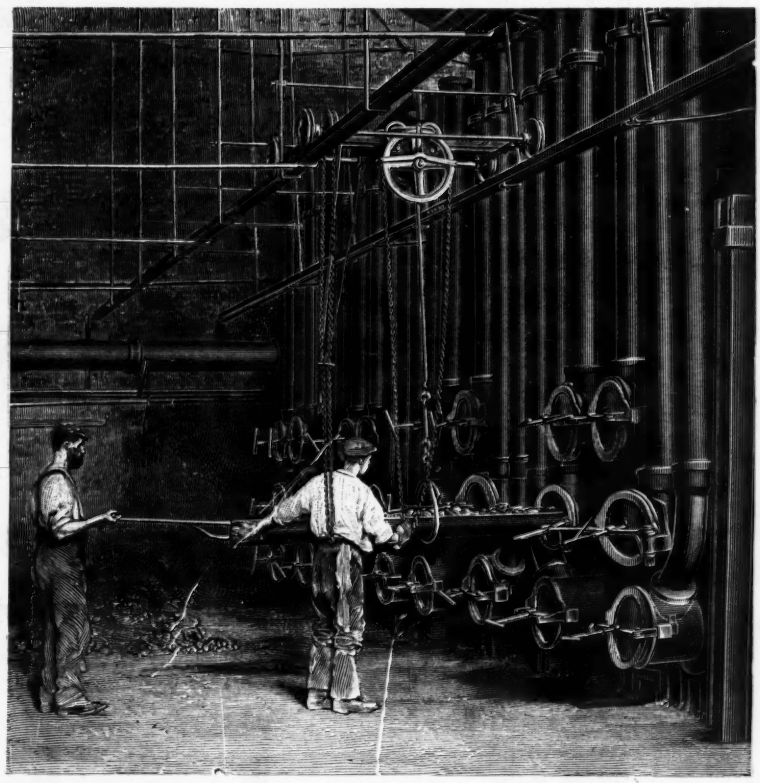

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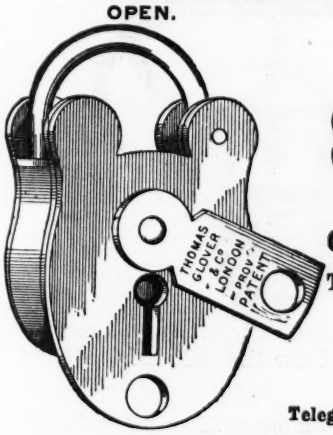


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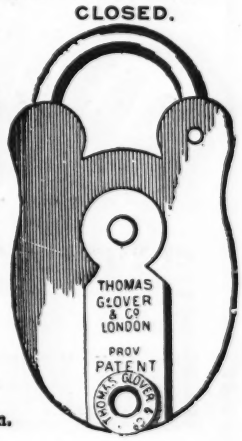


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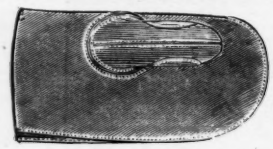

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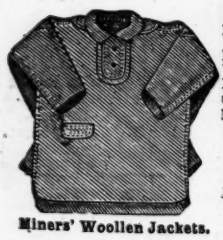

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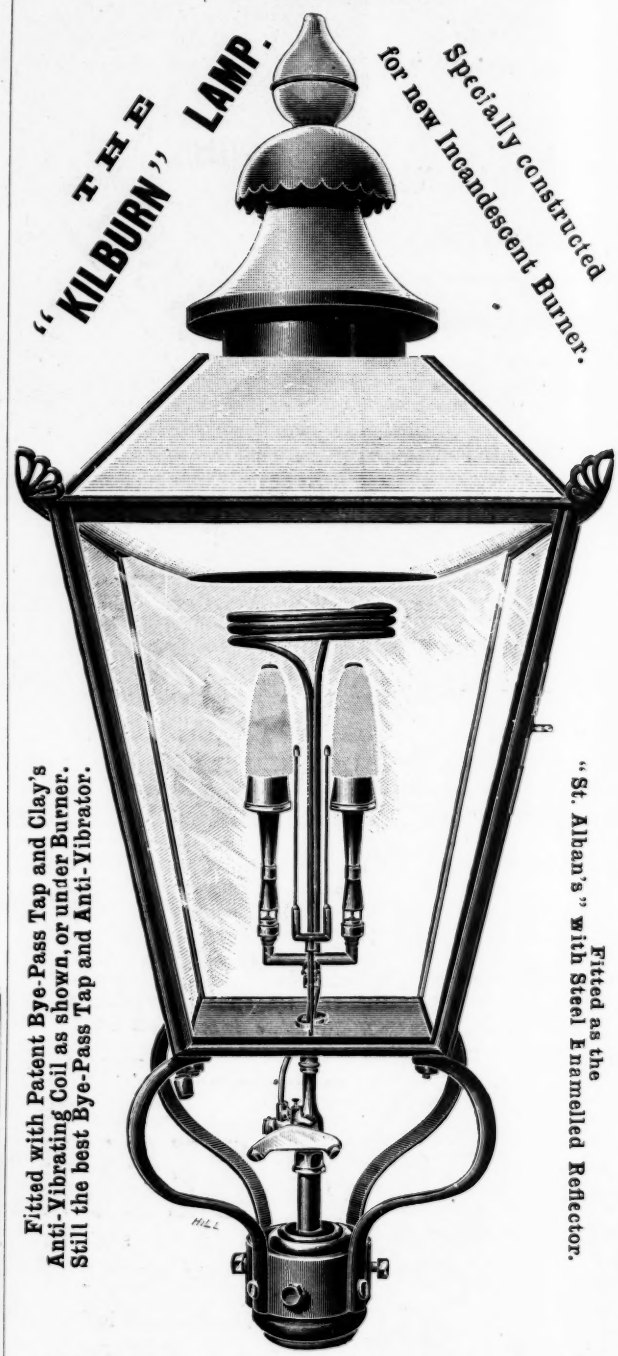

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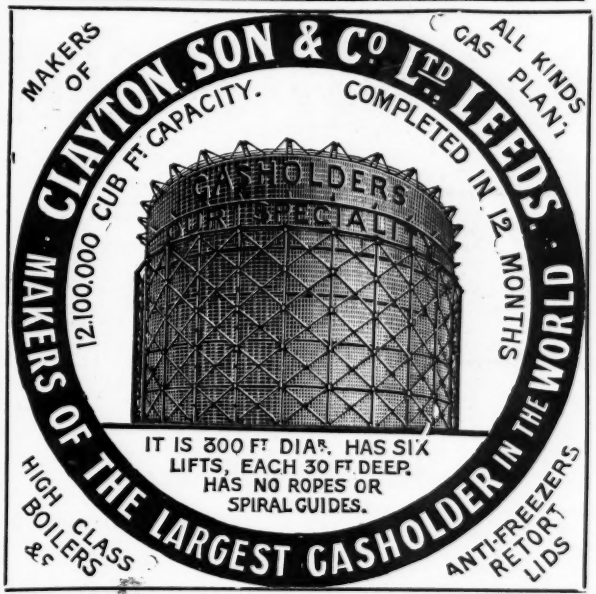
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IT IS 300 FT DIAM. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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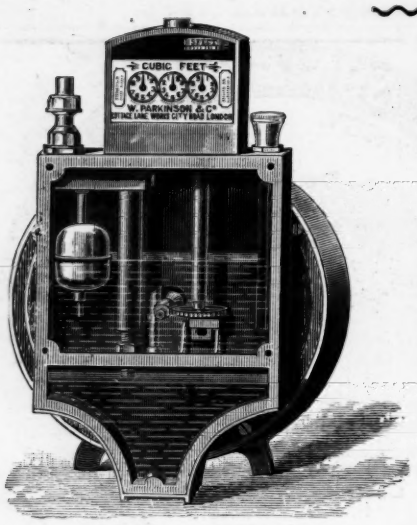
**FOR SULPHATE OF AMMONIA OR OTHER PLANTS.**

With this Superheater, the **Temperature of the Liquor can be raised to 190° Fahr. before entering the Still** by means of the Waste Gases only; **Steam and Fuel are saved; the capacity of the Plant is increased; the cheapest unrefined acid can be used; and less condensing power is required.**

Prices and Particulars on Application.

# PARKINSON AND W. & B. COWAN, LTD.

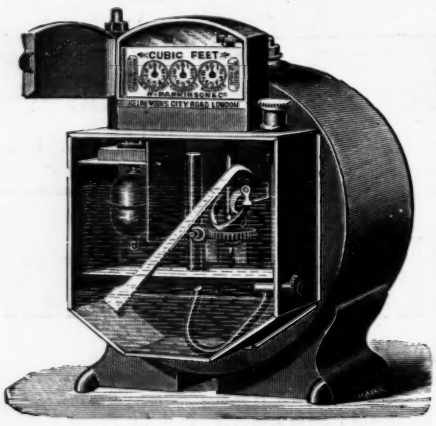
**(PARKINSON BRANCH.)**




## ORDINARY WET METERS

*IN CAST-IRON CASES.*

Work with very little friction. Will stand very high pressures. Cannot possibly be shut off by sudden increase of pressure, the Float being affected by Outlet Gas only. Allow for loss of water by evaporation without materially affecting the registration or shutting off the gas. Unexcelled for simplicity of construction, excellence of workmanship, or accuracy in registration.




## COMPENSATING METERS

*IN TINNED OR CAST-IRON CASES.*

The Slow-Spoon Compensator has been in extensive use for many years; it maintains an unvarying water-line without appreciable friction, and provides a large reserve of water. The Float arrangement allows sudden or excessive pressure on the Inlet without affecting the working of the Meter or extinguishing the Lights.

## DRY METERS.

These Meters are unsurpassed for accuracy of registration. The cases are made of the best Charcoal Tin Plates; and each part of the Meter is stamped by special Machinery to ensure uniformity and exactness in construction. The Diaphragms are all of the best Persian Sheep Skins, carefully selected, and the brasswork and smaller fittings are of superior workmanship.

**COTTAGE LANE WORKS, CITY ROAD,**

**LONDON.**

Telegrams: "INDEX." Telephone No. 778 King's Cross.

**BELL BARN ROAD WORKS,**

**BIRMINGHAM.**

Telegrams: "GASMETERS." Telephone No. 1101.

[See also Advt. on p. 192.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